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# % WATER RESOURCES ABSTRACTS



VOLUME 5, NUMBER 17 SEPTEMBER 1, 1972 SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information are now provided by NTIS.

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# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior



VOLUME 5, NUMBER 17 SEPTEMBER 1, 1972

W72-09789 - W72-10438

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

# FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCU-MENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established disciplineoriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Rioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Resources Research U.S. Department of the Interior Washington, D. C. 20240

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#### 02 WATER CYCLE

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# **SELECTED WATER RESOURCES ABSTRACTS**

#### 01. NATURE OF WATER

## 1B. Aqueous Solutions and Suspensions

VISCOSITY AND CONDUCTIVITY STUDIES, Miami Univ., Fla. W. Drost-Hansen, and L. Korson

w. Dross-Hansen, and L. Korson.
For sale by the Superintendent of Documents, U.
S. Government Printing Office, Washington, D. C.
20402 Price \$0.50. Office of Saline Water Research
and Development Progress Report No. 349, Aug.
1968. 74 p. 32 fig, 8 tab, 69 ref, 4 append. OSW 1401-0001-461.

Descriptors: \*Viscosity, \*Conductivity, \*Aqueous solutions, \*Saline water systems, Temperature, Water properties, Electrolytes, Sodium chloride, Sodium sulfate.

Identifiers: Methanol, Ethanol, n-Propanol, n-Bu-tanol, n-Pentanol, n-Hexanol, t-Butanol, Potassi-um chloride.

Viscosity and conductivity studies were made on water and aqueous solutions. Viscosity measure-ments were made on water, dilute aqueous solu-tions of the lower normal aliphatic alcohols, sodi-um chloride and sodium sulfate. Two procedures um chloride and sodium sulfate. Two procedures were followed. Initial measurements were made employing the standard, manual timing technique; this was subsequently superseded by instrumentation which included a highly precise, semi-automatic device. Apparent (Arrhenius) energy of activation values for viscous flow of water have been determined at temperatures ranging from 8 to 70 deg. C in one degree increments. This represents the most precise energy of activation data for water ever reported. As a result, a function which represents the viscosity of pure water tion which represents the viscosity of pure water at all temperatures within this region has been produced. The viscosity experiments on the lower aliphatic alcohols were undertaken to provide data apparently not available in the literature. Measure-ments have been made on t-butyl alcohol in aquements have been made on t-butyl alcohol in aqueous solutions. Very careful measurements have been made on the viscosity of dilute sodium chloride solutions. The viscosity of a dilute solution of sodium sulfate has been measured. Conductivity measurements made by very careful, 'point-by-point' determinations, have tended to suggest the existence of thermal anomalies. Some evidence for anomalies was also obtained in the continuous runs. If the effect is real it is undoubtedly of very small magnitude. Whether or not this effect is related to a bulk property of the electrolyte solution studied or is perhaps a manifestation of a specific, electrode-electrolyte process (which may be particularly sensitive to structural changes of water adjacent to the interface) remains to be determined. Measurements have also been made of the conductivity of dilute elecremains to be determined. Accounteness are also been made of the conductivity of dilute electrolyte solutions in mixed solvents. So far, measurements have been made primarily in the presence of methyl alcohol as the non-electrolyte. W72-09920

# 02. WATER CYCLE

#### 2A. General

A MODIFIED CATCHMENT MODEL OF THE UPPER TAIERI RIVER, OTAGO, NEW ZEA-LAND, Aston Univ., Birmingham (England). Dept. of

Asson Only, Bliningham (England). Dept. of Civil Engineering. P. Hutchinson, and I. Simmers. Journal of Hydrology (New Zealand), Vol 10, No 1, p 2-21, 1971.3 fig., 1 tab, 7 ref, append.

Descriptors: \*Model studies, \*Water yield, \*Rainfall-runoff relationships, \*Data collections, Mathematical models, Statistical models, Regression analysis, Correlation analysis, Runoff forecasting, Simulation analysis. Identifiers: \*New Zealand, \*Taieri River (N.Z.). Because it is often not possible to collect data which are ideal for use with mathematical catchment models, it is a useful exercise to determine whether the type of data commonly available can be employed in a model. These conditions can be found in the Upper Taieri River catchment, Otago, New Zealand, which possesses the disadvantages, as far as digital simulation is concerned. of its size of 233 square miles, its varied physical and hydrological characteristics, and its lack of adequate data. Estimating runoff from rainfall by a simple correlation and regression gives results of limited value in this area. Using a modified model to predict runoff, the correlation is increased for all months except two. Even when the data are far from ideal, it is worthwhile to develop and use a mathematical catchment model for the prediction of runoff, as this has proved more useful than the simple methods. However, in this instance the final results fall short of what is desired for water resources assessment purposes. (Knapp-USGS). W72-09874

LOW FLOW CHARACTERISTICS ON THREE ROCK TYPES OF THE EAST COAST, AND THE TRANSLATION OF SOME REPRESENTA-TIVE BASIN DATA,

Ministry of Works, Napier (New Zealand). Water and Soil Div.

For primary bibliographic entry see Field 02E. W72-09875

# COMPUTATION MODEL FOR RADIATIVE

FLUXES, Canterbury Univ., Christchurch (New Zealand).

Dept. of Geography. J. E. Hay. Journal of Hydrology (New Zealand), Vol 10, No 1, p 36-48, 1971. 1 fig, 1 tab, 16 ref.

Descriptors: \*Solar radiation, \*Evapotranspiration, \*Mathematical models, Regression analysis, Statistics, Statistical models, Heat balance, Energy budget, Heat budget, Hydrologic cycle, Soil moisture, Climatology, Meteorology. Identifiers: \*Radiation balance, New Zealand.

A model is described which enables the monthly mean intensites of the component fluxes of the radiation balance to be computed. Standard cli-matological (screen-height temperature and hu-midity and the cloud amount) and locational (both spatial and temporal) data are the basic inputs to spania and temporary data are the space injust of the model. An accuracy analysis, in which computed and instrumentally observed values are compared, indicates that the accuracies of the two methods are comparable. The benefits of knowing the intensities of the individual and net radiative fluxes in hydrological research are reviewed. The ability of the model to produce values of the direct and diffuse shortwave fluxes means that the values valid for horizontal surfaces may be corrected to take local site characteristics into ac-count. Thus the model has an application on both the regional and basin scales. (Knapp-USGS) W72-09876

# WATER RESOURCES INVESTIGATIONS IN NORTH CAROLINA, 1969. Geological Survey, Washington, D.C.

Available Free on request to USGS, Washington, DC 20242. Geological Survey Report of Investigations Folder, 1 sheet, 1969. 5 fig, 1 map, 2 tab.

Descriptors: \*Water resources, \*Investigations, \*North Carolina, \*Inter-agency cooperation, Surveys, Planning, Hydrologic data, Basic data col-Veys, Franking, Nythologic data, passe data collections, Streamflow, Groundwater, Precipitation (Atmospheric), Runoff, On-site investigations, Water temperature, Sediment transport, Water quality, Dissolved solids, Water level fluctuations, Bibliographies, Networks, Maps.

Identifiers: \*Cooperative water-studies program,

Research projects.

Water resources studies in North Carolina are summarized. A selected bibliography of material concerning the State is included. A list is given of State and Federal agencies, counties, and cities who cooperate in different parts of the program. The hydrologic data network consists of 181 primary, secondary, and water management streamflow stations; 82 groundwater observation wells; and 95 water quality observing sites. Small State maps show principal sources of groundwater, mean annual precipitation, average annual runoff, ead the dissolved solids in ground and surface waters. A map, scale 25 mi to the inch, shows by symbols, numbers, and colored outline the hydrologic data network and investigations in North Carolina in January 1969. (Woodard-USGS) W72-10256

ANALYSIS OF RESIDUAL HYDROLOGIC STOCHASTIC PROCESSES, Illinois Univ., Urbana. Dept. of Civil Engineering. S. J. Kareliotis, and V. T. Chow. Journal of Hydrology, Vol 15, No 2, p 113-130, February 1972. 12 fig, 7 ref. OWRR A-029-ILL (5).

Descriptors: \*Stochastic processes, \*Model studies, \*Statistical models, \*Mathematical models, Water balance, Time series analysis, Synthetic hydrology, Simulation analysis, Systems analysis. Identifiers: \*Stochastic models.

After the trend and periodicity components are After the trend and periodicity components are removed from a hydrologic process, the remaining components are defined as the residual hydrologic processes. Hydrologic watershed systems consist mainly of the stochastic processes of precipitation, runoff, evapotranspiration, and watershed storage, and are related by the water balance equation. The residual hydrologic stochastic processes of the watershed as a multiple of the watershed system are treated as a multiple time series. They may be analysed by the cross-spectrum and partial cross-spectrum theory to determine the correlation structure of the processes involved. The method of analyses was applied to monthly data from the upper Sangamon River basin above Monticello in east central Illinois. A set of models for the residual hydrologic stochastic processes of the watershed were ob-tained and then used to form a stochastic model which may be employed to generate stochastic streamflows. (Knapp-USGS) W72-10268

#### A STOCHASTIC MODEL OF RUNOFF-PRODU-CING RAINFALL FOR SUMMER TYPE

STORMS, Arizona Univ., Tucson. For primary bibliographic entry see Field 06A. W72-10270

# HYDROSIM--COMPUTERIZED STREAM HYDROGRAPH SIMULATION, Montana State Univ., Bozeman. Water Resources

Research Center.

Available from the National Technical Informa-tion Service as PB-210 589, \$3.00 in paper copy, \$0.95 in microfiche. Montana Water Resources Research Center Report No. 22, December 1971. 26 p, 1 fig, 2 ref. Project No. OWRR A-048-MONT

Descriptors: "Hydrographs, "Simulation, "Com-puter programs, "Hydrograph analysis, Watersheds (Basins), Discharge (Water).

Drainage basin discharge may be simulated by treating the drainage basin as a storage-discharge phenomenon. Stream hydrograph analysis is used to estimate the position of a curve showing the relationship of discharge to expected values of storage. Hydrograph analysis is also used to estimate graphical relationships between a rainfall relationships between a rai index and rainfall recharge of basin storage, and to estimate graphical relationships between a snow-melt index and snowmelt recharge of basin

#### Group 2A-General

storage. Snowfall in the basin is also estimated from a weather index. These estimates are used in conjunction with a water budget equation to approximate a discharge hydrograph for the basin. The discharge hydrograph is computed by a FOR-TRAN IV program called HYDROSIM. The computed hydrograph is changed by trial and error adjustment of the aforementioned graphs until a satisfactory correspondence between simulated and real hydrographs is obtained. (Holje-Montana) W72-10434

#### 2B. Precipitation

FORECASTING TYPE OF PRECIPITATION, National Weather Service, Garden City, N.Y. Eastern Region.

Available from NTIS Springfield, Va. 22151. Price \$3.00 paper copy; \$0.95 microfiche. National Oceanic and Atmospheric Administration Technical Memorandum NWS ER-45, January 1972. 10 p, 4 fig, 1 tab, 4 ref.

Descriptors: \*Precipitation (Atmospheric), \*Weather forecasting, \*Meteorology, \*Climatology, Meteorological data, Model studies, Methodology, Input-output analysis. Identifiers: \*Precipitation forecasting, Eastern

An objective technique for forecasting precipita-tion up to 48 hours in the eastern United States is presented. The method can be used to determine if the probability of a precipitation type is greater than 80%, between 50% and 80%, or less than 50%. The procedure can be automated to produce precipitation type forecasts for any location as a by-product of the operational primitive equation (PE) model. After additional data becomes availa ble for analysis, the technique can be refined if warranted, so as to have a separate forecast procedure for each of many locations, and to present the forecast as a probability of occurrence to the nearest 10%) of each precipitation type. Four precipitation types are considered: (1) liquid, (2) frozen, (3) liquid and frozen combined, and (4) freezing. (Woodard-USGS).

W72-09856

PRELIMINARY ATLAS OF 1.0, 0.5, AND 0.1
PERCENT PRECIPITATION INTENSITIES FOR

Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

H. A. Salmela, N. Sissenwine, and R. W. Lenhard. Available from the National Technical Informa-tion Service as AD-736 406, \$3.00 in paper copy, \$9.95 in microfiche. Air Force Cambridge Research Laboratories Environmental Research Papers, No 374 (AFCRL-71-0527), October 1971. 33 p. 24 fig. 1 ref

Descriptors: \*Rainfall intensity, \*Precipitation intensity, \*Tropical regions, \*Asia, \*Duration curves, Probability, Frequency analysis, Statistics, Risks, Climatology, Military aspects. Identifiers: Southeast Asia.

Using preliminary statistical relationships between precipitation intensities averaged over 1 - min duprecipitation intensities averaged over 1 - min au-rations and commonly available monthly cli-matological tabulations of precipitation, rainfall rates for 1.0, 0.5, and 0.1 percent exceedances were computed for weather stations over Europe and Asia for which monthly totals and frequency of daily precipitation were available for the months of January, April, July, and October. Isolines of intensities were drawn delineating reisolines of intensities were drawn delineating re-gions of low and high rates for each precipitation frequency. These rates may be used for obtaining calculated-risk design criteria for military equip-ment and for the evaluation of the probability of operational problems when the intensity of precipitation equalled or exceeded with various low probabilities may be critical. (Knapp-USGS) W72-10241

A PRECIPITATION ESTIMATION TECHNIQUE A PRECIPITATION ESTIMATION TECHNIQUE FOR DEVELOPING IOSHYETS IN AN ARID AREA USING VEGETATION AND TOPO-GRAPHIC PARAMETERS, California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology. S.A. Bamberg, and H. N. Friesen. Nevada University Desert Research Institute Research Report, 1971. 23 p, 11 fig, 6 tab, 8 ref, append. OWRR B-038-NEV (1).

Descriptors: \*Isohyets, \*Rainfall, \*Topography, \*Arid lands, \*Vegetation effects, Mapping, Meteorological data, Climatology, Statistical methods, Distribution patterns, Nevada.

A technique using vegetation data was used for developing an isohyet map for the Hualapai Val-ley, a closed hydrologic basin of about 315 square miles in the northwestern Great Basin in Nevada. In this basin there is practically no climatic data and in the northwest Great Basin there are too few stations for determination of rainfall on a detailed basis. Using a vegetational typing to represent a range in elevation and precipitation, an initial mean annual rainfall is determined for selected mean annual rainfail is determined for selection points on a grid pattern. This calculated rainfall is then modified by using topographic parameters of slope, orientation, exposure, and rainfall shadow effect. The resulting point determinations of mean annual rainfall are smoothed using a trend surface analysis, and an isohyetal map is drawn from the smoothed points. The technique provides an estimated accuracy of one inch of mean annual precipitation and one mile of resolution on isohyets. (Knapp-USGS)

THE DETERMINATION OF THE NON--VOLATILE ACIDITY OF RAIN WATER BY A COULOMETRIC PROCEDURE, Rome Univ. (Italy). Istituto di Chimica Aanlitica. For primary bibliographic entry see Field 07B. W72-10254

ACID RAIN, Cornell Univ., Ithaca, N.Y. Section on Ecology and Systems. For primary bibliographic entry see Field 05B. W72-10261

A STOCHASTIC MODEL OF RUNOFF-PRODU-CING RAINFALL FOR SUMMER TYPE STORMS, Arizona Univ., Tucson. For primary bibliographic entry see Field 06A.

W72-10270

RESULTS OF A DECADE OF ORSERVATIONS OF ATMOSPHERIC PRECIPITATION IN GLA-CIAL AND NIVAL AREAS OF THE ZAILISKI ALA TAU (NEKOTORYYE REZUL'TATY DESYATILETNIKH NABLYUDENIY ZA AT-MOSFERNYMI OSADKAMIV GLYATSIAL'NO-NIVAL'NOY ZONE ZAILIYSKOGO ALATAU), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Sektor Fizicheskoi Geografii. P. A. Sudakov, R. S. Bekten'yarov, and S. N.

Nigmatulayeva.

In: Glyatsiologicheskiye issledovaniya v Kazakhstane: No 9. Rezhim lednikov Kazakhstana; Iz-datel'stvo 'Nauka' Kazakhskoy SSR, Alma-Ata, p 18-27, 1971. 2 fig, 3 tab, 2 ref.

Descriptors: \*Meteorology, \*Precipitation (Atmospheric), \*Rain, \*Snow, \*Glaciers, Orography, Mountains, Slopes, Elevation, Streamflow, Water year, Seasonal, Summer, Winter, Distribution patterns, Fluctuations, Precipitation gages. Identifiers: \*USSR, \*Kazakhstan, \*Zailiski Ala Tau, \*Glacier nourishment, Orographic precipita-

Data of 70 rainfall stations and of over 100 snow fall stations in glacial and nival areas of the Zailiski Ala Tau range in east Kazakhstan for the period 1957-69 were used to study distribution of annual and seasonal precipitation in liquid and solid form, accumulation of snow on glaciers, and role of rain and snow in glacier nourishment and mountain streamflow. Considerable annual fluctuations of precipitation were recorded. Mean annual precipitation for the period of record was 1,170 mm. Maximum precipitation occurred in 1965-66, when total rainfall was generally 280 mm more and in the Malaya Almatinka basin almost 450 mm in the Malaya Almatinka basin almost 450 mm more than the mean annual precipitation. Least annual precipitation occurred in 1961-62 and was 162 mm below the mean annual value. Mean maximum and minimum values observed were 1,552 mm and 890 mm, respectively. The highest amount of rain-fall was recorded at elevations of 3,500-3,600 m, where annual totals were considerably greater than 1,000 mm. Significant differences between maximum and minimum amounts of precipitation were observed in summer and winter periods. (See also W72-10298) (Josefson-USGS) W72-10303

#### 2C. Snow, Ice, and Frost

ADDITIVES FOR MODIFYING THE FROST SUSCEPTIBILITY OF SOILS, PART 1, Cold Regions Research and Engineering Lab., T. W. Lambe, and C. W. Kaplar. Army Cold Regions Research and Engineering Laboratory Technical Report 123, Pt 1, March 1971. 41 p, 9 fig, 17 tab, 20 ref, append.

Descriptors: \*Frost action, \*Frozen soils, \*Soil aggregates, \*Frost prevention, \*Flogineering struc-tures, Frost protection, Additives, Soil chemistry, Testing, Waterproofing, Methodology, Disper-sion, Cement grouting, Resins, Data collections, Evaluation, Laboratory tests, On-site investiga-

Fifty-two additives to reduce the frost susceptivility of soil were tested on 25 soils. The theoretical considerations underlying the choice of additives are discussed. The additives are divided into five groups according to their action in soil: (1) void fillers and cements, (2) aggregants, (3) metallic salts, (4) waterproofers, and (5) dispersants. A number of additives, especially dispersants and polyvalent cation salts, merit further laboratory evaluation. Resins and waterproofers also look promising. Four freeze-thaw cycles on four different dispersant-treated soils treated in the laboratory showed no diminution of effectiveness of treatment. A small-scale field test showed a laboratory-proved dispersant to be effective under field cor measurements made over two seasonal freezing cycles showed retention of original effectiveness of the dispersant treatment. (Woodard-USGS) W72-09879

GREAT LAKES SNOW REDISTRIBUTION RESEARCH PROJECT (DRAFT ENVIRONMENTAL IMPACT STATEMENT. National Oceanic and Atmospheric Administra-

tion, Rockville, Md. For primary bibliographic entry see Field 03B. W72-09903

EARLY STAGES OF THE GROWTH OF ICE IN THE AIR AT LOW PRESSURE,
Waterloo Univ. (Ontario). Dept. of Electrical En-

gineering.
P. A. Chatterton, and J. D. Cross.
Nature Physical Science, Vol 230, No 67, p 91-92,
April 10, 1972. 4 fig, 6 ref.

Descriptors: \*Ice, \*Cryology, \*Electron microscopy, \*Atmospheric pressure, \*Crystallography, Freezing, Electrical studies, Supercooling.

Ice formed by condensing low pressure water vapor onto a surface below 80 K is amorphous in structure, and there is evidence that becomes crystalline when heated to 150 K. Optical

microscopes are severely limited in depth of focus and resolution and therefore electron microscopy was used to observe the surface structure. In the was used to observe the surface structure. In the observed range of temperature and pressure the ice can be formed on a cold surface in the specimen chamber of a scanning electron microscope, and can then be studied directly with the instrument. A hollow stainless steel stub was mounted on a thermally insulating support on the specimen stage. The stub was cooled by cold nitrogen gas. Ice formed by condensing low pressure water vapor at 160 K shows no crystalline features. Application of electric fields up to 500 kV/cm has no influence on the crystal growth. The kV/cm has no influence on the crystal growth. The growth mode of ice crystals in mesospheric conditions differs markedly from those in tropospheric conditions. (Knapp-USGS)

GLACIER OF KAZAKHSTAN (REZHIM LED-NIKOV KAZAKHSTANA). Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Sektor Fizicheskoi Geografii.

Glyatsiologicheskiye issledovaniya v Kazakh-stane: No 9, Izdatel'stvo 'Nauka' Kazakh-skoy SSR, Alma-Ata, 1971. 160 p.

\*Glaciation \*Glaciers. Descriptors: Descriptors: "Glaciers, "Glaciation, "Glaciohydrology, "Orography, Climatology, Meteorology, Heat balance, Radiation, Hydrolog-ic budget, Precipitation (Atmospheric), Ice, Snow, Firn, Melt water, Ablation, Runoff, Streamflow forecasting, Water chemistry, Avalanches, Com-

puters. \*USSR, \*Kazakhstan, \*Glacial geomorphology, \*Glacier mass budget, Glacier nourishment, Glacier wastage, Glacier runoff, Snow line, Firn line.

This collection of 17 papers examines the climatic factors responsible for development of glacial processes in Kazakhstan. Included are papers dealing briefly with hydrologic regime of glaciers and their response to climatic change; heat balance and ablation of ice and snow on glaciers; precipitaand ablation of ice and snow on glaciers; precipitation and snow in glacial zones; precipitation-runoff from firn fields; chemical composition of glacial melt waters; and hydrologic importance of avalanche activity. Separate papers are devoted to the geography of glaciers and to application of BESM-3M digital computers to calculation of plane and height coordinates of reference points for study of glacier dynamics. (See also W72-10299 thru W72-10303) (Josefson-USGS) W72-10298

METROROLOGICAL GLACIOHYDROLOGICAL **OBSERVATIONS** ON THE CENTRAL TUYUKSU GLACIER (METEOROLOGICHESKIYE I NEKOTORYYE GLYATSIOGIDROLOGICHESKIYE NABLYU-DENIYA NA TSENTRAL'NOM TUYUK-SUYSKOM LEDNIKE), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Sektor Fizicheskoi Geografii.

T. A. Shchukina. In: Glyatsiologicheskiye issledovaniya v Kazakh-stane: No 9. Rezhim lednikov Kazakhstana; Iz-datel'stvo 'Nauka' Kazakhskoy SSR, Alma-Ata, p 28-32, 1971. 5 tab, 8 ref.

Descriptors: \*Meteorology, \*Glaciohydrology, \*Glaciers, \*Ice, \*Snow, Firn, Ablation, Melting, Runoff, Precipitation (Atmospheric), Air temperature, Radiation.
Identifiers: \*USSR, \*Kazakhstan, \*Glacier wastage, \*Glacier runoff, \*Glacier mass balance, Checis teasure Firm.

Glacier tongues, Firn line.

Precipitation and air-temperature data for 1956-68 were used to study loss of ice and snow from the Central Tuyuksu glacier in the Malaya Almatinka River valley in Kazakhstan in 1962-67. Area of diminution of ice and snow in 1962 was 5,942 sq m and 1967, 5,822 sq m. Total mass of glacier loss in 1962-67 was 31,507 sq m (mean annual wastage5,251 sq m). Water-equivalent values of ice removed from the glacier tongue in 1962-67 ranged between 6.841 million and 6.875 million cu m (mean annual water output-1.146 million cu m). Relationships were established between duration of ablation periods and the glacier's basic glaciohydrological indices, including area of glacier wastage, glacier runoff, elevation of the firn line, and the ablation gradient. (See also W72-10298) (Josefson-USGS)

EFFECTS OF CLIMATIC FACTORS ON HYDROLOGIC BUDGET OF GLACIERS (KLIMATICHESKAYA OBUSLOVLENNOST'-MATICHESKAYA OBUSLOVLEN GIDROLOGICHESKOGO REZHIMA

NIKOV), Akademiya Nauk Kazakhskoi SSR, Alma-Ata.

Akademiya Nauk Madanasan Sobi, Madanasan Sektor Fizicheskoi Geografii.
K. G. Makarevich, and T. Ya. Denisova.
In: Glyatsiologicheskiye issledovaniya v Kazakhstane: No 9. Rezhim lednikov Kazakhstana; Izdatel'stvo 'Nauka' Kazakhskoy SSR, Alma-Ata, p 39-49, 1971. 5 fig, 3 tab, 16 ref.

Descriptors: \*Glaciers, \*Glaciohydrology, \*Hydrologic budget, \*Climatology, \*Climates, Meteorology, Precipitation (Atmospheric), Air temperature, Air masses, Air circulation, Mountains, Orography, Snow, Ice, Ablation, Melting, Runoff, Seasonal, Fluctuations. Identifiers: \*USSR, \*Kazakhstan, \*Zailiski Ala Tau, \*Dzungarian Ala Tau, \*Glacier mass budget, Glacier mass balance, Glacier runoff, Snow line.

Mass balance studies were conducted in 1956-67 in Mass balance studies were conducted in 1956-67 in east and southeast Kazakhstan to study interrelationships between climate and glaciers. To analyze atmospheric circulation, the classification of macrosynoptic processes according to Soviet climatologists Vangenheim, Girs, and Baydal for 1930-67 was used. With the meridional E type of circulation, conditions are favorable for positive glacier mass budget. Fluctuations of height of snow line on glaciers of the Zailiski and Dzungarian Ala Tau and Kazakhstan Altay mountain ranges. an Ala Tau and Kazakhstan Altay mountain ranges correlate with well-defined atmospheric circulatory systems. (See also W72-10298) (Josefson-USGS) W72-10300

INVESTIGATIONS OF METEOROLOGICAL AND RADIATION CONDITIONS OF MELTING IN THE ACCUMULATION ZONE OF THE CEN-TRAL TUYUKSU GLACIER (ISSLEDOVANIYA METEO-RADIATSIONNYKH USLOVIY TAYANIYA V OBLASTI AKKUMULYATSII LEDNIKA TSENTRAL'NOGO TUYUKSUYS

KOGO),
Akademiya Nauk Kazakhskoi SSR, Alma-Ata.
Sektor Fizicheskoi Geografii.
T. Ya. Denisova, and R. G. Golovkova.

In: Glyatsiologicheskiye issledovaniya v Kazakhstane: No 9. Rezhim lednikov Kazakhstana; Izdatel'stvo 'Nauka' Kazakhskoy SSR, Alma-Ata, p 33-38, 1971, 2 tab. 2 ref.

Descriptors: \*Glaciers, \*Meteorology, \*Radiation, \*Ablation, \*Melting, Heat balance, Air circulation, Weather, Precipitation (Atmospheric), Orography, Seasonal, Synoptic analysis.

Identifiers: \*USSR, \*Kazakhstan, \*Zailiski Ala
Tau, \*Glacier mass budget, \*Snow line.

Components of the radiation, heat, and meteorological regimes on glaciers of the Zailiski Ala Tau range in southeast Kazakhstan were analyzed in August and September 1966-67 in connection with air circulation and weather conditions above the Central Tuyuksu glacier and the radiaabove the Central Tuyuksu glacier and the radiation and heat balance of the glacier surface. The height of the seasonal snow line in 1966 was 3,735 m and in 1967, 3,720 m. At the end of August and beginning of September 1966, weather conditions were conducive to appreciable glacier melt. In August 1966, melting was 4.6 cm, in September-1.6 cm, and in August 1967-3.7 cm. (See also W72-10298) (Josefson-USGS) W72-10301

OROGRAPHY AND PRESENT-DAY GLACIATION IN THE BAYANKOL RIVER BASIN IN
SOUTHEAST KAZAKHSTAN (OSNOVNYYE
CHERTY OROGRAFII I SOVREMENNOGO
OLEDENENIYA BASSEYNA E. BAYANKOL NA
YUGO-VOSTOKE KAZAKHSTANA),
Akademiya Nauk Kazakhskoi SSR, Alma-Ata.
Sektor Fizicheskoi Geografii.
Ye. N. Vilesov, and M. E. Grudzinskiy.
In: Glyatsiologicheskiye issledovaniya v Kazakhstane: No 9. Rezhim lednikov Kazakhstana; Izdatel'stvo 'Nauka' Kazakhskoy SSR, Alma-Ata, p
5-17, 1971. 3 fig, 4 tab, 12 ref.

Descriptors: \*Glaciology, \*Glaciation, \*Glaciers, \*Orography, Geomorphology, Valleys, Slopes, River basins, Glacial drift, Firn, Ablation, Hyp-

sometric analysis, Dimensions, Size, Aerial photography. Identifiers: \*USSR, \*Kazakhstan, \*Glacial geomorphology, \*Glacial morphometry, \*Glacier types, Valley glaciers, Corrie glaciers, Hanging glaciers, Glacier wastage.

Investigations of the orography and extent of present-day glaciation in the Bayankol River basin in southeast Kazakhstan were based on recent aerial photographs of recognized glaciers and of tiny masses of ice excluded from earlier classifications. The total number of glaciers in the basin is tions. The total number of glaciers in the basin is 114 and covers 136.8 sq km, of which 6.4 sq km is covered by moraine. The number of glaciers smaller than 0.1 sq km is 25, and the number larger than 10 sq km is 2. Total volume of the glaciers is 11.1 cu km. Three basic types of glaciers—valley, corrie, and hanging—cover more than nine-tenths of the glaciated area. Data are given on number and areal distribution of the different morphological glacier types and on wastage of the largest glaciers for the period 1902-63. (See also W72-10298) (Josefson-USGS) W72-10302

RESULTS OF A DECADE OF OBSERVATIONS OF ATMOSPHERIC PRECIPITATION IN GLA-OF ATMOSPHERIC PRECIPITATION IN GLA-CIAL AND NIVAL AREAS OF THE ZAILISKII ALA TAU (NEKOTORYYE REZUL'TATY DESYATILETNIKH NABLYUDENIY ZA AT-MOSFERNYMI OSADKAMI V GLYATSIAL'NO--NIVAL'NOY ZONE ZAILIYSKOGO ALATAU), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Sektor Fizicheskoi Geografii. For primary bibliographic entry see Field 02B. W72-10303

#### 2D. Evaporation and Transpiration

SOLAR DISTILLATION IRRIGATION AP-PARATUS, For primary bibliographic entry see Field 03F. W72-0979

COMPUTATION MODEL FOR RADIATIVE FLUXES, Canterbury Univ., Christchurch (New Zealand). Dept. of Geography. For primary bibliographic entry see Field 02A.

SEASONAL VARIATIONS AND DIURNAL CHANGES IN TRANSPIRATION OF CHAMAECYPARIS OBTUSA ON CLEAR DAYS

Tokyo Univ. (Japan). School of Agriculture. Y. Morikawa.

J Jap Forest Soc. Vol 53, No 7, p 219-221. 1971. Illus. Identifiers: Air, \*Chamaecyparis obtusa G, \*Diurnal, Humidity, \*Seasonal, Temperature, \*Trans-

#### Group 2D-Evaporation and Transpiration

The transpiration of C. obtusa during summer, fall and spring, was more intensive in the morning when it was more humid. In the winter, transpiration decreases due to the decrease in air temperature. In summer, during dry days, transpiration was weak, because the pores were closed.—Copy-right 1972, Biological Abstracts, Inc. W72-10161

#### 2E. Streamflow and Runoff

TRAVELTIME AND CONCENTRATION ATTENUATION OF A SOLUBLE DYE IN ANTIETAM AND CONOCOCHEAGUE CREEKS,

Geological Survey, Parkville, Md. For primary bibliographic entry see Field 05B. W72-01245

A MODIFIED CATCHMENT MODEL OF THE UPPER TAIERI RIVER, OTAGO, NEW ZEA-

Aston Univ., Birmingham (England). Dept. of Civil Engineering. For primary bibliographic entry see Field 02A.

W72-09874

LOW FLOW CHARACTERISTICS ON THREE ROCK TYPES OF THE EAST COAST, AND THE TRANSLATION OF SOME REPRESENTA-TIVE BASIN DATA, Ministry of Works, Napier (New Zealand). Water

and Soil Div. P. J. Grant.

Journal of Hydrology (New Zealand), Vol 10, No 1, p 22-35, 1971. 6 fig, 4 tab, 5 ref.

Descriptors: \*Low flow, \*Base flow, \*Recession curves, \*Hydrogeology, Statistics, Rainfall-runoff relationships, Water balance, Water yield, Deptharea-duration analysis, Correlation analysis, Regression analysis, Aquifer characteristics. Identifiers: \*New Zealand.

Low flows on 13 limestone, 13 siltstone and 9 argillite basins of the East Coast, North Island, New Zealand were measured at two- or three-day intervals during a dry period. For each rock type, low flows and their recession coefficients (k) during a 16-day reference period were related to various basin morphological features and to normal annual rainfall. Recession coefficients differed significantly: for limestone basins mean k=0.975, for siltsone mean k=0.924, and for argillite ba k=0.905. On limestone, normal annual rainfall explains 96% of the variation in base flow, on siltstone rainfall explains 41% of base flow, while on argillite only 6% is thus accounted for. On argillite the best simple explanation is basin area, which explains 62%. The higher the basin k value, the more efficient is the long-term basin storage factor and hence the closer is the relation between longterm average storage input (normal annual rainfall) and base flow at any time during normal recession.

Annual rainfall and water yield data from both representative basins correlate highly (r=0.98) and therefore afford a means, where rainfalls are well defined, of estimating annual water yield from silt-stone and limestone basins. The influence of rock type on flow to recognize rock type rather than broad hydrological region. (Knapp-USGS) W72-09875

REPEATABILITY IN ESTUARINE HYDRAULIC

Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 02L. W72-10264

AN ECOLOGICAL AND RECREATIONAL USE SURVEY OF THE LUXAPALILA RIVER, Mississippi State Univ., State College. School of Forest Resources.

For primary bibliographic entry see Field 06B.

W72-10267

LONGITUDINAL DISPERSION IN NONU-NIFORM FLOW, Johns Hopkins Univ., Baltimore, Md. Chesapeake For primary bibliographic entry see Field 05B. W72-10278

RADIANT ENERGY TRANSFER IN WATERS, Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
For primary bibliographic entry see Field 02K.
W72-10282

FLOW CHARACTERISTICS OF MARYLAND

Geological Survey, Parkville, Md. P. N. Walker.

P. N. Walker.
Available from Md. Geol. Survey, 214 Latrobe Hall, Johns Hopkins Univ., Baltimore, Md. 21218 \$2.50. Maryland Geological Survey Report of Investigations, No 16, 1971. 160 p, 3 fig, 1 plate, 4 tab, 2 append.

Descriptors: \*Streamflow, \*Flow characteristics, \*Flow measurement, \*Flow rates, \*Maryland, Stream gages, Gaging stations, Flood frequency, Hydrologic data, Basic data collections, Peak discharge, Low flow, Droughts, Precipitation (Atmospheric), Participation mospheric). Reviews.

Mean annual discharge, magnitude and frequency of high and low flows, and flow-duration data are presented for 112 long-term continuous-record gaging stations in Maryland. These data are based on records that were available through September 30, 1967, and include the drought of the 1960's. The magnitude and frequency of selected low flows are presented for 6 short-term continuousflows are presented for 6 short-term continuous-record stations and for 44 low-flow partial-record stations to provide additional areal coverage. A method for determining flood frequency at ungaged sites is described. Empirical equations relate physical features of a drainage system to peak discharges of selected recurrence intervals. These equations provide a user with the means to estimate the magnitude and frequency of flood peaks at an ungaged site and to evaluate the relative re-liability of his estimate. (Woodard-USGS) W72-10326

STORM WATER RUNOFF FROM AN URBAN HIGHWAY DRAINAGE SYSTEM, District of Columbia Dept. of Highways and Traf-fic, Washington. Materials Development and Research Div For primary bibliographic entry see Field 04C. W72-10342

DISCHARGE MODEL OF THE MISSISSIPPI RIVER: EVALUATION OF THE IMPACT OF DIVERSION OF WATER TO TEXAS, Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.

O. Arguello. Ph D Thesis, May 1972. 132 p, 14 fig, 31 tab, 20 ref. Project No. OWRR A-016-LA (1).

Descriptors: \*Streamflow forecasting, \*Mississip-ni River. \*Mathematical models, \*Estuaries, pi River, \*Mathematical models, \*Estuaries, \*Saline water intrusion, Gulf of Mexico, Hydrologic data, Regression analysis, Equations, Diversion losses, Computer programs, Input-output analysis.
Identifiers: \*New Orleans (La), \*Vicksburg

(Miss), Statistical analysis.

Mathematical models were developed to compute the daily discharges of the Mississippi River at Vicksburg and New Orleans, and to predict the movement of the salt-water wedge from the Gulf of Mexico to New Orleans. The discharges at Vicksburg can be predicted for six days in ad-vance, based on the daily discharges at several stations on the Mississippi River and on the discharges of the Mississippi's main tributaries. The model for predicting movement of the salt-water wedge from the Gulf to New Orleans can be used in conjunction with the discharge model to give early warning to the New Orleans area as to the date that the salt content of the water will rise. the date that the salt content of the water will rise. Examples of prediction of periods of high salt con-centration at New Orleans are included. The 40 years (1928-1967) of published discharge records at Red River Landing and at Tarbert Landing were used to estimate the discharges at New Orleans, superimposing the effects of possible diversions of ter to Texas. The effects of such diversion on the salt concentration at New Orleans were then determined as if the diversion had been operating throughout the period of record. (Woodard-USGS)

WEST VIRGINIA'S BUFFALO CREEK FLOOD: A STUDY OF THE HYDROLOGY AND EN-GINEERING GEOLOGY, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 08B.

W72-10353

#### 2F. Groundwater

UNCONFINED FLOW THROUGH JOINTED

ROCK, E. Castillo, G. M. Karadi, and R. J. Krizek. Water Resources Bulletin, Vol 8, No 2, p 266-281, April 1972. 13 fig, 1 tab, 9 ref. S-021-ILL (1).

Descriptors: \*Groundwater movement, \*Joints (Geologic), Fractures (Geologic), \*Mathematical models, \*Numerical analysis, Laminar flow, Turbulent flow, Permeability, Viscosity, Density, Roughness (Hydraulic).

The two-dimensional, steady-state, unconfined flow of a homogeneous fluid through jointed rock was studied for both laminar and turbulent conditions by use of a method which is based on theoretical and experimental flow relationships. Only the independent unknowns are computed in order to reduce the complexity of the problem and render it more readily tractable. The intact rock is assumed to be impermeable, and two intersecting systems of plane, parallel joints are responsible for all permeability in the mathematical model, taking into account the surface roughness of the joints. The mathematical solution of the resulting nonlinear system of equations is obtained by use of a rapidly converging iterative procedure, in which each iteration takes special advantage of the banded nature of the associated matrix. For the particular case in which a free surface exists, the general flow equations are not satisfied, because some of the joints in the vicinity of the free sur-face do not flow full; therefore, new equations must be established to handle this condition. Once the development of the mathematical model is ac-complished, several cases involving different geometric characteristics (width, orientation, and geometric characteristics are (wall, orientation, and roughness of joints) are solved for a rectangular domain, and graphs are given to illustrate the in-fluence of the various parameters on the manifested flow behavior. (Knapp-USOS)

SOLUTION INTENSITY ON VARIOUS TYPES OF CALCAREOUS ROCKS IN OF CZECHOSLOVAKIA, CZECHOSLOVAKIA, Akademie Ceskoslovenska Geograficky Ustav. Brno. For primary bibliographic entry see Field 02K. W72-09851

THE CONTRAST BETWEEN DERBYSHIRE AND YORKSHIRE IN THE AVERAGE VALUE OF CALCIUM CARBONATE IN THEIR CAVE AND KARST WATERS, Hull Univ. (England). Dept. of Geography.

Cave Research Group of Great Britain Transactions. Vol 14, No 2, p 151-152, March 1972. 8 ref.

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Descriptors: \*Karst hydrology, \*Water chemistry, \*Groundwater movement, Karst, Limestones, Calcium carbonate, Carbonate rocks, Leaching, Sampling, Water analysis.
Identifiers: \*Derbyshire (England), \*Yorkshire

The mean content of CaCO3 in karst waters in England is 53 ppm higher in Derbyshire (179.7 ppm) than in Yorkshire (123.5 ppm). The principal factors appear to be the flow-through time, dilution effects due to the proportion of shale interweaved with or overlying the limestone in the catchments, soil characteristics, and the amount of CaCO3 deposited during transportation. (Knapp-USGS) W72-09864

RESPONSES IN THE CHEMISTRY OF SPRING WATERS IN THE OXFORD REGION TO SOME CLIMATIC VARIABLES, Christ's Coll., Liverpool (England).

K. Paterson. Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 132-140, March 1972. 3 fig, 5 tab, 15 ref, append.

Descriptors: \*Karst hydrology, \*Geochemistry, \*Water chemistry, \*Weathering, Groundwater movement, Water analysis, Sampling, Mineralogy, Limestones, Permeability, Erosion. Identifiers: Oxford (England).

Calcium hardness of karst water often varies quite markedly over short periods. This study describes a method of examining such variations as they are observed in spring waters in the Oxford region, using multiple linear regression analysis. A positive relationship between precipitation and calcium hardness was most marked over intervals up to the party water provents of I month. Faster and more turbulent movements of groundwaters associated with heavier rainfalls lead to higher rates of solution. The effect of heavy rainfall entering the limestones is also to expel waters which have a higher hardness. expel waters which have a higher hardness. Waters displaced from the limestones have been within the system for a period of considerable duration. A negative relationship was found over very short intervals between calcium hardness and precipitation. This can probably be explained by dilution by heavy rainfall. The short interval which these waters spend within the limestone can often prevent them from attaining a high degree of saturation and a high calcium hardness. Negative correlation with air temperature can be explained by assuming that the higher hardness concentrations assuming that the higher hardness concentrations represent chemical concentrates washed down from the upper soil layers during the colder months of the year. The negative relationship may also reflect the increased solubility of carbon diox-ide with decreasing temperatures. (Knapp-USGS) W72-09866

AN ACCURATE METHOD FOR CALCULAT-ING SATURATION LEVELS OF GROUND WATERS WITH RESPECT TO CALCITE AND

DOLOMITE, Pennsylvania State Univ., University Park. Dept. of Geosciences. For primary bibliographic entry see Field 02K. W72-09870

CHEMISTRY OF CARBONATE DENUDATION IN NORTH AMERICA, McMaster Univ., Hamilton (Ontario). Dept. of

R. S. Harmon, J. W. Hess, R. W. Jacobson, E. T.

Cave Research Group of Great Britain Transac-tions, Vol 14, No 2, p 96-103, March 1972. 4 fig, 3

Descriptors: \*Water chemistry, \*Karst hydrology, \*Weathering, Climates, Erosion, Groundwater movement, Saturation, Calcium carbonate, Car-

bon dioxide, Soil water, Groundwater, Hydrogeology, Geochemistry.

Some 230 water samples from a karst aquifer net-work and from a variety of sampling localities in the United States and Mexico were analyzed. The chemical evolution of the karst waters as they chrough the aquifer system can be traced and each kind of water carries a characteristic chemical signature. Climatic influences appear best in the spring waters but even here local variations dominate. (Knapp-USGS).

OPTICAL BRIGHTENERS--A NEW WATER TRACING REAGENT, Lancaster Univ., Bailrigg (England).

R. R. Glover.

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 84-88, March 1972, 12 ref, 4

Descriptors: \*Dye releases, \*Fluorescent dye, \*Tracers, \*Karst hydrology, Karst, Analytical techniques, Fluorometry, Tracking techniques.

Optical brighteners intended for fabric treatment are a new class of water tracing reagent. Although colorless in daylight, they fluoresce blue under ultra-violet light. They can therefore be used in areas where visible coloration of streams cannot be tolerated. They show a strong affinity to cellu-lose, even in cold water, and cotton wool can be used as a passive detector. In solution, they can be detected at dilutions of less than one millionth, comparable with existing tracers, but with the advantage of being cheap, colorless, nontoxic, non-carcinogenic, and easily decomposed by sunlight into harmless components. (Knapp-USGS) W72-09882

PRELIMINARY OXIDATION STUDIES ON SOME CAVE WATERS FROM SOUTH WALES, For primary bibliographic entry see Field 02K. W72-09885

DRAWDOWN IN A FINITE CIRCULAR AQUIFER WITH CONSTANT WELL DISCHARGE,

Iowa State Geological Survey, Iowa City.

L. K. Kuiper. Water Resources Research, Vol 8, No 3, p 734-736, June 1972. 1 fig, 4 ref.

Descriptors: \*Drawdown, \*Transmissivity, \*Nu-merical analysis, Groundwater movement, Un-steady flow, Withdrawal, Storage coefficient, Discharge (Water).

An analytical solution is derived for the groundwater head in a confined, homogeneous, isotropic aquifer with a constant thickness and a circular impermeable boundary around a well penetrating the entire depth of the aquifer and discharging at a constant rate. The solution is compared with the Theis solution, which is valid for an aquifer of un-limited extent. The two solutions agree very close-ly at small radial distance. (Knapp-USGS)

A DIGITAL COMPUTER MODEL FOR PRE-DICTING REGIONAL AQUIFER RESPONSE, Texas Tech Univ., Lubbock. Dept. of Civil En-

T. R. Knowles, B. J. Claborn, and D. M. Wells. Water Resources Center Report WRC-71-7 (ICASALS Special Report No 52), December 1971. 11 fig, 5 tab, 14 ref, 2 append.OWRR C-1537 (No 1993) (5).

Descriptors: \*Hydrogeology, \*Groundwater, \*Confined water, \*Aquifers, \*Computer models, Equations, Data processing, Drawdown, Pumping, Analytical techniques, Hydrographs, Systems alysis, Input-output analysis, Computer programs, Boundary layers, Groundwater movement, Aquifer characteristics, Hydrologic data. Identifiers: Pumping node.

A groundwater model developed for unconfined conditions was used as the starting point to develop an improved method of simulation for an unconfined system. This improvement involved the development of the equations and a method of solution of the equations. The second objective was to develop a modeling procedure for a confined aquifer that follows the same pattern as does the unconfined modeling procedure. This would allow the model to be used for either an unconfined or a confined aquifer. The procedure discussed will adequately model a confined or an unconfined groundwater system. A rectangular nodal system is recommended, when the geometry oncolar system is recommended, when the geometry of the groundwater system permits, for the following reasons: (1) the irregular nodal system requires memory area for the bookkeeping arrays which restricts the maximum number of nodes; and (2) the time required by the irregular nodal bookkeeping procedure increases program execution time. (Woodard-USGS) W72-10262

APPRAISAL OF SHALLOW GROUND-WATER RESOURCES, PUEBLO ARMY DEPOT, COLORADO, Geological Survey, Denver, Colo. Water

Geological Survey, Deares, Resources Div. F. A. Welder, and R. T. Hurr. Geological Survey Open-file Report 71006, December 1971, 44 p. 10 fig, 5 plate, 5 tab, 7 ref.

Descriptors: "Groundwater, "Water wells, "Water yield, "Water quality, "Colorado, Hydrogeology, Aquifers, Pumping, Withdrawal, Geology, Aquifer characteristics, Hydrologic data, Data collections, Specific capacity, Transmissivity. Identifiers: "Pueblo Army Depot (Colo).

The water supply for the Pueblo Army Depot, 15 miles east of Pueblo, Colo., is obtained from wells that tap an aquifer in terrace alluvium. Withdrawals have resulted in a water-level decline of 27 feet, which adversely affects the discharge rate of individual wells. Furthermore, excessive pumpage has resulted in progressive deterioration of water quality. Over a 20-year period, hardness has increased from 70 mg/liter to 135 mg/liter and nas increased from 70 mg/liter to 135 mg/liter and dissolved-solids content has increased from 250 mg/liter to 370 mg/liter. Two new supply wells were drilled in the southern part of the Depot and were tested to determine aquifer properties and probable yields. The hydraulic conductivity determined from these tests ranged from about 350 to mined from these tests ranged from about 330 to nearly 600 gallons per day per square foot. The transmissivity for the full thickness of the aquifer is in the range of 7,500 to 12,000 gallons per day per foot. The two new supply wells can be pumped at a combined rate of about 140 gallons per minute. If pumpage in the existing well field is reduced by the same amount, some recovery of water levels in the field will occur and the trend in water quality deterioration may slow or even reverse. (Woodard-USGS)

SURVEY OF INTERSTATE AND INTERNA-TIONAL AQUIFER PROBLEMS, Bittinger (M. W.) and Associates, Inc., Fort Col-

Bitting Colo. M. W. Bittinger. Ground Water, Vol 10, No 2, p 44-54, March-April 1972. 2 fig. 1 tab. OWRR C-1195 (No 3144) (3).

Descriptors: \*Aquifers, \*Interstate, \*International waters, \*Aquifer systems, \*Political aspects, Reviews, Water resources development, Hydrogeology, Water rights, Boundary disputes. Identifiers: Interstate aquifer problems, Internative activities. tional aquifer problems.

A survey of State water agency and university per-sonnel was conducted to identify and classify in-

#### Group 2F-Groundwater

terstate and international aquifer problems in the conterminous United States. Questionnaires returned identified nearly 200 of such situations. Of these, 30 situations were classified as being a major problem at the present time. An additional 73 situations were classified as minor at the present time. For those problems that were indicated as being expected to develop within the next five years, 9 were classified as major and 25 as minor. For those problems that were indicated as being expected to develop after five or more years, 19 were classified as major and 42 as minor. (Knapp-USGS) W72-10265

THREE-DIMENSIONAL BRANCHING-TYPE MODELS OF FLOW THROUGH POROUS

Illinois Univ., Urbana. Dept. of Civil Engineering. L. Torelli, and A. E. Scheidegger.

Journal of Hydrology, Vol 15, No 1, p 23-35, January 1972. 10 fig, 3 ref. OWRR C-1613 (3146)

Descriptors: \*Dispersion, \*Tracers, \*Dye releases, \*Porous media, \*Groundwater movement, Diffusion, Mixing, Path of pollutants, Mathematical studies, Mathematical models,

The total path followed by the various fractions of a spot of dye injected into a porous medium through which flow is occurring may be modeled by various types of three-dimensional branching configurations (graphs), the mass of the dye being distributed on the free vertices of the graphs. The graphs are generated according to two different cyclic random procedures. Using each procedure samples of graphs are generated in a given number of cycles. In one class of models, the relation between the coefficient of longitudinal dispersion D and the average pore velocity v, and between the coefficient of lateral dispersion Dlat and v was: D varies as the 1.2 power of v; Dlat varies as v. This is in good agreement with the experimental results. (Knapp-USGS) W72-10272

SOLUTION OF TRANSIENT GROUNDWATER FLOW PROBLEMS BY THE FINITE ELEMENT

METHOD, Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.

Water Resources Research, Vol 8, No 3, p 725-727. June 1972. 8 ref.

Descriptors: \*Unsteady flow, \*Groundwater movement, \*Numerical analysis, Mathematical models, Hydraulic conductivity, Water storage, Infiltration, Finite element analysis.

The derivation of the basic equations of a finite element method for transient groundwater flow problems is simplified when the approximation of the time derivative by a finite difference equation is made before the introduction of the variational principle. Existing programs for steady state problems can easily be extended to the transient case in this way, and a stable numerical procedure can be obtained. (Knapp-USGS) W72-10273

GROUNDWATER FLOW IN AN IN-HOMOGENEOUS AQUIFER, Iowa State Geological Survey, Iowa City.

L. K. Kuiper. Water Resources Research, Vol 8, No 3, p 722-724, June 1972. 1 fig, 4 ref.

Descriptors: \*Groundwater movement, \*Hydraulic conductivity, \*Heterogeneity, \*Aquifer characteristics, Numerical analysis, Mathematical

Identifiers: \*Inhomogeneous aquifers.

An analytic solution was obtained for the ground-An analytic solution was obtained for the ground-water head in a confined inhomogeneous and isotropic aquifer of constant thickness. The verti-cal direction component of the groundwater flow is assumed to be zero. The specific storage is as-sumed to be a constant. The hydraulic conductivi-ty varies with distance of flow. The solution is compared graphically with the solution for the case where hydraulic conductivity is constant and an impermeable boundary exists. Head approaches its final value more rapidly for constant variable hydraulic conductivity. (Knapp-USGS) W72-10274 where hydraulic conductivity is constant and

ACCOUNTING FOR APPARATUS-INDUCED DISPERSION IN ANALYSES OF MISCIBLE DISPLACEMENT EXPERIMENTS, Geological Survey, Menlo Park, Calif. Water

Resources Div.

Resources Div.
R. V. James, and J. Rubin.
Water Resources Research, Vol 8, No 3, p 717-721, June 1972. 4 fig, 1 tab, 14 ref.

Descriptors: \*Dispersion, \*Path of pollutants, \*Porous media, \*Saturated flow, \*Unsaturated flow, Mixing, Stratified flow, Solutes, Calibrations, Laboratory tests, Equipment, Saline water intrusion, Saline water-freshwater interfaces.

Identifiers: \*Miscible displacement.

In studies of hydrodynamic dispersion in porous media there is some difficulty in theoretically predicting experimental breakthrough curves from laboratory columns. The greatest discrepancies occur for short-column experiments or studies of unsaturated media. Some of the disagreement can be eliminated by a quantitative treatment of ap-paratus-induced dispersion. The experimental system is treated as a two-layer construct in which the porous medium and the apparatus are considered as separate layers. The dispersion characteristics of the apparatus layer are determined independently in the absence of the porous material. The dispersion coefficient for the porous medium is obtained from a two-layer dispersion equation. The hydrodynamic dispersion coefficients calculated in this manner are as much as 40% lower than those obtained by the usual one-layer approach. (Knapp-USGS) W72-10275

MODELING THE PORE STRUCTURE OF POROUS MEDIA, Agricultural Research Service, St. Paul, Minn. Soil

and Water Conservation Research Div. D. A. Farrell, and W. E. Larson. Water Resources Research, Vol 8, No 3, p 699-706, June 1972. 2 fig, 19 ref.

Descriptors: \*Porous media, \*Mathematical models, \*Hydraulic conductivity, Saturated flow, Unsaturated flow, Pores, Groundwater movement, Soil water movement, Porosity, Capillary action, Capillary conductivity, Diffusion.

A physicomathematical alternative to capillaric modeling of the pore structure of prous media is proposed. With this model, the hydraulic conduc-tivity of porous materials is determined from a 'pore domain' characterization of the pore space by using an appropriate conductance theory for by using an appropriate conductance theory for estimating the flux contribution of the various components of heterogeneous media. The proposed model is versatile yet mathematically tractable and is capable of analyzing fluid flow through porous materials of widely differing structure including anisotropic and structured media. A comparative study of the predictions of this model with those of a model widely used in soil science is made for several media. Indiscriminate use of the soil water model may be responsible for the gross overpredictions of hydraulic conductivity for some porous materials and also for the reported distortions in the relationships between conductivity and the degree of saturation for some soils. (Knapp-USGS) W72-10276

DIGITAL SIMULATION OF THE BOUSSINESQ EQUATION FOR A WATER TABLE AQUIFER, Nova Scotia Dept. of Mines, Halifax. C. L. Lin.

Water Resources Research, Vol 8, No 3, p 691-698, June 1972. 5 fig, 16 ref.

Descriptors: \*Simulation analysis, \*Groundwater movement, Numerical analysis, Dupuit-Forchheimer theory, Water levels, Permeability, Unsteady flow, Water yield, Mathematical Unsteady flow, models, Drawdown. Identifiers: \*Boussinesq equation.

mathematical model was developed to simulate the Boussinesq equation for a two-dimensional water table aquifer. Transient solutions to the finite difference approximations based on an irregular mesh matrix were obtained by the alternating direction implicit method. The precision of the model was evaluated by comparing the volume of water pumped with the amount of water released from storage and the amount received from a near-by recharging river. The model is suitable for the study of transient flow in a permeable sand and gravel aquifer. (Knapp-USGS) W72-10281

GROUND-WATER RESOURCES OF NATRONA

GROUND-WATER RESOURCES OF NATRONA COUNTRY, WYOMING, Geological Survey, Washington, D.C. M. A. Crist, and M. E. Lowry.
Available from GPO, Washington, DC 20402, \$6.25 in paper cover. Geological Survey Water-Supply Paper 1897, 1972. 92 p, 21 fig, 3 plate, 4 tab, 44 ref.

Descriptors: \*Groundwater resources, \*Hydrogeology, \*Water yield, \*Water quality, \*Wyoming, Water wells, Water supply, Spring, Water utilization, Domestic water, Industrial water, Irrigation water, Municipal water, Livestock, Water levels, Aquifer characteristics, Pumping, Withdrawal, Maps, Hydrographs, Chemical analysis, Hydrologic data, Basic data collections. collections Identifiers: \*Natrona County (Wyo).

The general occurrence, chemical quality, and availability of groundwater in Natrona County, Wyoming, are described. Special attention is given to identifying the chemical suitability of groundwater for domestic, livestock, industrial, municipal, and irrigation use. More than 30 geologic formations are exposed in the county, 28 of which are known to yield water to wells and springs. The Madison Limestone of Mississippian age and the Tensleep Sandstone and the Casper Formation of Pennsylvanian and Permian age supply the largest yields to wells and springs. In the northeastern part of the county, flow from each of three wells in the Madison is more than 4,000 gpm. Each of three wells in the Tensleep in the same area flows more than 400 gpm. Yields of springs in the Casper For-mation near Casper Mountain range from about 1.0 to 17 cubic feet per second. Groundwater from near the outcrop of all these formations usually contains less than 500 mg/liter of dissolved solids. contains less than 500 mg/liter of dissolved solids. Dissolved-solids content increases with distance from the outcrop and in places is more than 3,200 mg/liter. Several types of water were found in this unit including sodium sulfate, calcium sodium sulfate, calcium sodium sulfate, calcium sodium sulfate, calcium sodium calcium sulfate, wodium calcium sulfate, wodium calcium bicarbonate. (Woodard-USGS) W72-10343

THE AGE AND CIRCULATION OF GROUND WATER IN THE MISSOULA VALLEY, MON-TANA, Montana State Univ., Bozeman. Water Resources

Research Center. R. L. Konizeski, and D. Alt.

Available from the National Technical Informa-tion Service as PB-210 565, \$3.00 in paper copy, \$0.95 in microfiche. Montana University Joint Water Resources Research Center Report No. 24, (June 1972). 59 p, 7 fig, 1 tab, 9 ref. Project No. OWRR B-024-MONT (3).

Descriptors: \*Groundwater, \*Water storage, \*Radioactive dating, \*Aquifers, \*Recharge wells, Montana, Groundwater resources, Water supply.

Western Montana is a region of high mountain ranges separated by broad valleys partly filled with up to several thousands of feet of unconsolidated to semiconsolidated sediments in which are stored enormous quantities of water. In the Missoula Valley a relatively small amount of this water, perhaps 20%, is stored in aquifers within the upper five or six hundred feet of the land surface, where some of it is now being discharged through wells. Recharge to these shallow aquifers is mostly by infiltration from surface runoff, irrigation and snow melt. Much larger quantities of is mostly by initiration from surface runoit, irrigation and snow melt. Much larger quantities of water, perhaps 80% of the total amount in storage, are stored in deeper aquifers which have not yet been penetrated by wells. Future economic development of the region will inevitably make increasing demands on the ground water reservoir as a source of potable water. The ultimate objective of this study was to help determine efficient guidelines for managing this valuable resource. The immediate objective was to study the ground water circulation patterns and recharge discharge relationships of the groundwater aquifers as revealed by the age of the water stored therein and by local geohydrologic controls. (Holje-Montana) W72-10432

# 2G. Water in Soils

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California Univ., Riverside. Dept. of Soils and Plant Nutrition. For primary bibliographic entry see Field 04D.

ERODIBILITY OF NEW ZEALAND SOILS, New Zealand Agricultrual Engineering Inst., Canterbury.
For primary bibliographic entry see Field 02J. W72-09877

ADDITIVES FOR MODIFYING THE FROST SUSCEPTIBILITY OF SOILS, PART 1, Cold Regions Research and Engineering Lab., For primary bibliographic entry see Field 02C.

A PRESSURE TRANSDUCER-TENSIOMETER FOR AUTOMATIC RECORDING OF SOIL-MOISTURE SUCTION IN THE FIELD, (IN Bundesanstalt fuer Bodenforschung, Hanover

(West Germany).
O. Strebel, W. Giesel, M. Renger, and S. Lorch.
Z. Pflanzenernaehr Bodenk. Vol 126 No 1 p 6-15.

1970. Illus. (English summary).
Identifiers: \*Automation, \*On-site tests, \*Soil moisture, Pressure, Suction, Tensiometer, Trans-

The resolution is + 1 cm water suction, due to high zero stability and low thermal shift; the response time is very short. Above the soil surface there are unte is very snort. Above the soil surface there are no thermal sensitive instrument parts which influence the results; the sensitivity to radiation and to air temperature below 0 degrees C therefore is eliminated. Measurements at greater depths are possible.—Copyright 1972, Biological Abstracts, Inc. W72-09880

LABORATORY SIMULATION OF LIMESTONE SOLUTION, University Coll. of Swansea (Wales). Dept of

Geography. For primary bibliographic entry see Field 02K. W72-09881

STUDIES ON THE EFFECTS OF SALINE IR-RIGATION WATERS ON THE PHYSICO-

-CHEMICAL PROPERTIES OF SOME SOILS OF RAJASTHAN, Udaipur Univ. (India). Coll. of Agriculture.

Udappur Univ., (Indua). Coli. of Agriculture. K. S. Singh, and R. P. Sharma. J Indian Soc Soil Sci. Vol 18 No 4 p 345-356, 1970. Identifiers: Adsorption, India, "Irrigation water, Rajasthan, Ratio, "Saline water, Sodium, "Soils.

The water used for irrigation at different localities falls into the classes of very high salinity and very high Na (C4S4), high salinity and high Na (C3S3), and high salinity and low Na (C3S1). Silt + clay, CaCO3, pH and calculated values of exchangeab Na percentage, Na adsorption ratio and S.S.P. (soluble Na percentage) of saturation extracts were higher in irrigated soils than in unirrigated ones while the reverse trend was observed with pore space. The light textured soils were less affected than heavier ones.--Copyright 1972, Biological Abstracts, Inc.

EFFECT OF RATE OF POULTRY MANURE AP-

PRICATION ON SELECTED SOIL CHEMICAL PROPERTIES, Arkansas Univ., Fayetteville. Dept. of Agronomy. For primary bibliographic entry see Field 05G. W72-10009

MOVEMENT OF POLLUTANT PHOSPHORUS IN SATURATED SOILS, Purdue Univ., Lafayette, Ind. Dept. of Agricul-

tural Engineering.
For primary bibliographic entry see Field 05B. W72-10032

NITROGEN REMOVAL FROM SEWAGE WATERS BY PLANTS AND SOIL, Maryland Univ., College Park. Dept. of Agronomy. For primary bibliographic entry see Field 05G. W72-10035

THE INFLUENCE OF WEATHER, CROP AND SAMPLING DEPTH ON THE MEASUREMENT OF PORE SIZE DISTRIBUTION IN THE ARA-BLE LAYER OF SOME CULTIVATED SILT SOILS, Rijksfaculteit der Landbouwwetenschappen,

Ghent (Belgium). L. K. M. De Leenheer.

Soil Sci. 112 (2): 89-99. 1971.

Jensification (Company) (1974)

The influence of soil moisture at the time of sampling is so important that undisturbed soil samples for pF-determinations are taken only at the er the winter (March). The soil in the arable layer should be at or slightly above field capacity and at its maximum as regards swelling. The total pore space (= 100) deduced from a measurement of the water content at pFO (suction of 1 cm) is preferred to the total porosity TP as calculated from bulk density. The soils studied are silt soils of the most fertile agricultural area of Belgium. Neither field capacity nor wilting percentage are constants (soil characteristics) for these soils, but the available water capacity (pore group pF2,54-pF4,19) is a nearly constant value. The volume of the poregroup pFO-pF2,54 is very sensitive to the influence of weather (to changes of moisture content) and is referred to as 'structure-related porositent) and is referred to as 'structure-related porosity.' The influence of crop (wheat or sugarbeet) on the pore size distribution seems to be less important than the influence of weather. Depth of sampling influences the moisture-porosity relationship. The sign of the correlation may change with depth.—Copyright 1972, Biological Abstracts, Inc. W72-10117 WATER MOVEMENT IN A FIELD SOIL DUR-ING DRAINAGE AND SUBIRRIGATION, North Carolina State Univ., Raleigh. For primary bibliographic entry see Field 04A. W72-10122

A SIMPLIFIED METHOD FOR THE DETER-MINATION OF SELENIUM IN SOILS AND

MINATION OF SELECTION IN SOLES AND SEDIMENTS,
Food and Agriculture Organization of the United Nations, Pendik (Turkey). Sheep and Goat Diseases Research Labs.
For primary bibliographic entry see Field 05A. W72-10252

EFFECTS OF IRRIGATION WITH SEWAGE ON FERTILITY OF SOD-PODZOLIC SANDY LOAM SOILS (VLIYANIYE OROSHENIYA STOCHNYMI VODAMI NA PLODORODIYE DERNOVO-PODZOLISTYKH SUPESCHANYKH For primary bibliographic entry see Field 03C. W72-10259

MOISTURE DYNAMICS IN SUBSIDING LOESSES AFTER WETTING (O DINAMIKE VLAZHNOSTI LESSOVYKH SADOCHNYKH POCHVO-GRUNTOV PRI

IKH ZAMACHIVANII), Vsesoyuznyi Nauchno-Issledovatelskii Institut Gidrotekhniki i Melioratsii, Moscow (USSR). A. Ye Mikhaleva.

Pochvovedeniye, No 10, p 58-64, October 1971. 2 fig, 3 tab, 10 ref.

Descriptors: \*Soil physics, \*Soil water movement, \*Wetting, \*Loess, \*Land subsidence, Soil physical properties, Water table, Water loss, Soil moisture, Capillary water, Gravitational, water, Percolating water, Percolation, Infiltration, Saturation, Ditches, Trenches, Soil moisture meters, On-site investigations.
Identifiers: \*USSR, \*Tadzhikistan, Vakhsh River, Film water.

Film water.

On-site investigations were conducted in the Vakhsh River valley in southwest Tadzhikistan to study movement of water in strongly subsiding loesses after initial and repeated wetting. Soil moisture content and rate of soil wetting were determined by neutron-meter measurements to depths of 25 m. The size and infiltration area of surface water sources determine the rate of wetting and formation of wetted soil zones. Rate of gravity flow and degree of soil water saturation increase with increase in size of the water source. This accelerates the subsidence rate of loess and produces changes in its hydrophysical properties. These changes include (1) increase in soil waterholding capacity; (2) decrease in water conductivity; (3) decrease in gravity flow; and (4) increase in capillary-and film-water movement. (Josefson-USGS)

MEASURING CHLORIDE IN EFFLUENT FLOWING FROM A SOIL COLUMN, Florida Univ., Gainesville. Dept. of Soil Science.

R. S. Mansell, and A. Elzeftawy.
Soil Science Society of America Proceedings, Vol
36, No 2, p 378-380, March-April 1972. 4 fig, 4 ref.
OWRR A-013-FLA (4).

Descriptors: \*Water chemistry, \*Instrumentation, \*Chlorides, \*Soil water, Leaching, Aqueous solutions, Analytical techniques, Soil moisture, Solutes, Calibrations. Identifiers: \*Soil solution.

An inexpensive flow cell and combination chloride electrode system can continuously record the chloride concentration in effluent flowing from a soil column. The response is sufficiently fast for monitoring effluent at flow rates normally encoun-tered in column studies of soils. Break-through

#### Group 2G-Water in Soils

curves for chloride solutions displaced through a column of glass beads are in close agreement with corresponding breakthrough curves obtained by argeniometric titration of aliquots collected from the same effluent. (Knapp-USGS) W72-10269

MODELING THE PORE STRUCTURE OF POROUS MEDIA,

Agricultural Research Service, St. Paul, Minn. Soil and Water Conservation Research Div. For primary bibliographic entry see Field 02F. W72-10276

WATER AND AIR REGIMES OF DRAINED, THICK HUMUS-PEAT SOILS AND MOISTURE AVAILABILITY TO CROPS (VODNO-VOZDUS-HNYY REZHIM I VLAGOOBESPECHENNOST' SEL'SKOKHOZYAYSTVENNYKH KUL'TUR NA OSUSHAYEMYKH PEREGNOYNO-TO-RFYANYKH MOSCHNYKH POCHVAKH), VSESOYUZNJY NAUCHO-ISSIEdOVATEISKI Institut Gidrotekhniki i Melioratsii, Moscow (USSR). Ye. P. Panov, and K. N. Shishkov. Pochvovedeniye, No 10, p 83-93, October 1971. 4

Pochvovedeniye, No 10, p 83-93, October 1971. 4 fig, 6 tab, 27 ref.

Descriptors: \*Land reclamation, \*Soil water, \*Moisture availability, \*Soil gases, \*Crops, Crop production, Vegetable crops, Industrial crops, Grains (Crops), Grasses, Soil types, Humus, Peat, Precipitation (Atmospheric), Groundwater, Water storage, Consumptive use, Irrigation, Drainage, Lysimeters. \*USSR, \*Moscow Oblast, \*Soil air.

Water and air regimes of thick Humus-Peat soils on the Yakhroma River floodplain (Moscow Oblast) were examined in 1965-70 in steel lysimeters measuring 0.8 to 1.2 sq m and 1-2 m deep, and in field experiments on plots of the 'Dmitrovskiy' sovkhoz. The soils studied consisted of woodysedge and sedge-woody, well-decomposed peat with a high ash content, fed by groundwaters in deposits 2-4 m thick. Favorable water and air regimes were created in soils during the growing season when soil drainage depths were 65-130 cm for vegetables and industrial crops, 60-100 cm for grain crops, and 50-85 cm for grasses. These drainage depths ensure high crop yields, regardless of the amount of precipitation. (Josefson-USGS)

DETERMINATION OF THE DEGREE OF SOIL WATERLOGGING FROM PROPERTIES OF CONCRETIONS (OPREDELENIYE STEPENI ZABOLOCHENNOSTI POCHV PO SVOYSTVAM KONKRETSIY),

VAM KONKRETSIY),
Moscow State Univ. (USSR). Faculty of Biology
and Soil Science.

F. R. Zaydel'man, and A. K. Ogleznev. Pochvovedeniye, No 10, p 94-101, October 1971. 2 tab, 3 ref.

Descriptors: \*Land reclamation, \*Saturated soils, \*Impervious soils, \*Hardpan, \*Soil properties, Soil profiles, Soil analysis, Chemical analysis, Analytical techniques, Metals, Iron, Manganese, Excess water (Soils), Perched water, Drainage, Land use, Podzols. Identifiers: \*USSR. \*Moscow Oblast, \*Water-

Identifiers: \*USSR, \*Moscow Oblast, \*Water-logging, \*Concretions.

Principles and techniques for quantitative determination of the degree of water-logging of fine-textured Podzolic soils in the Central noncher-nozem zone of the western and northwestern parts of Moscow Oblast were based on analysis ophysical and chemical properties of concretions (hardpans) in soil surface horizons. The quantitative characteristics examined included: (1) signs of excessive wetness in the top (1.5 m) layer of soil; (2) presence and depth of perched water in the middle of the growing season; (3) drainage needs as related to land-use planning; and (4) percent of

dark gray hardpans to total number of hardpans. The concept of a waterlogging index of mineral soils, based on relation of the degree of soil waterlogging to the Fe:Mn ratio, was shown to be specific and closely connected with the morphological, hydrological, agronomic, and ecological characteristics of excessively wet soils. (Josefson-USGS)
W72-10305

CONTENTS OF TOTAL AND MOBILE TRACE ELEMENTS IN ERODED SOILS OF THE LU-GANSK REGION, (IN RUSSIAN), L. A. REGION,

L. I. Akent'eva.
Mikroelem V Sel'Sk Khoz; Med Resp Mezhved
Sb. Vol 5. pl39-145. 1969.

Identifiers: \*Trace elements, Fertilizer, Lugansk, Mobile, \*Eroded soils, \*USSR.

A relationship was established between the total contents of the trace elements Zn, Cu, Mo, Mn, Co and the nature of soil-forming rocks. The contents of mobile forms were considerably lower in eroded than in uneroded soils. Eroded soils need microfertilizers.—Copyright 1972, Biological Abstracts, Inc. W72-10309

VARIATION OF THE HYDROPHYSICAL PRO-PERTIES OF GRAY-BROWN SOILS IN RELA-TION TO THE MICRORELIEF, (IN AZER-BAIJANI).

R. Memmedov, and R. Memmedov. Uch Zap Azerb Univ Ser Geol-Geogr Nauk. 2. 93-98. 1969. (Russian summary).

Identifiers: Amelioration, Irrigation, \*Porosity, \*Soils, \*USSR.

The gray-brown soils are the main soil type on the Apsheron Peninsula. The elevations of such soils on the territory of the Binagady vineyard differ by less than 1.1 to more than 3 m. Data are provided on the bulk weight of the upper layer of soils, their total porosity and hydrophysical properties which should be considered in various amelioration and irrigation programs.—Copyright 1972, Biological abstracts, Inc. W72-10310

WATER MOVEMENT IN UNSATURATED SOILS AS INFLUENCED BY GYPSUM, Commonwealth Scienific and Industrial Research

Commonwealth Scienific and Industrial Research Organization, Deniliquin, Australia. Div. of Plant Industry. M. L. Sharma.

Australian Journal of Soil Research, Vol 10, No 1, p25-33, March 1972. 6 fig, 2 tab, 23 ref.

Descriptors: \*Soil water movement, \*Water chemistry, \*Gypsum, Calcium, Electrolytes, Wetting, Drying, Hydraulic conductivity, Diffusivity, Soil structure, Permeability, Ion exchange, Unsaturated flow, Australia.

Three soils varying in texture and exchangeable sodium were treated either with distilled water or with a gypsum solution and their diffusivity, capillary conductivity, and weighted mean diffusivity were determined. Gypsum resulted in increased diffusivity and hydraulic conductivity. The increases were more pronounced near saturation and declined with desaturation. The soil with the highest clay content and exchangeable sodium percentage responded most. Wetting and draining cycles resulted in decreased diffusivity for all soils when distilled water was used, but only in two soils when 10 or 30 m-equiv. Solutions were used. In the soil most responding to gypsum, diffusivity was slightly increased with increasing number of wetting and draining cycles when gypsum solutions were used. This was due probably to rebuilding of structure by cation exchange, which was lost by slaking and dispersion during the first wetting and draining cycle. The electrolyte concentration of flowing solution did not significantly affect the water flow properties provided that the

slaking and dispersion were reduced by a solution of high concentration during the process of cation exchange. (Knapp-USGS) W72-10325

FLOODED RICE SOILS OF NORTHERN AUSTRALIA: I. CHANGES IN SALINITY, Commonwealth Scientific and Industrial Research Organization, Darwin (Australia). Coastal Plains Research Station.

Australian Journal of Soil Research, Vol 10, No 1, p 43-51, March 1972. 6 fig, 11 ref.

Descriptors: \*Soil chemistry, \*Salinity, \*Aquatic soils, \*Rice, Irrigation, Hydrogen ion concentration, Oxidation-reduction potential, Saline soils, Leaching, Australia.

Soil salinity, pH, and Eh were determined in two soil types on the Adelaide River plains (Northern Territory, Australia) throughout the growing period of a rice crop. Both the total salinity, as indicated by specific conductivity values of the soil solution, and individual ion species were followed at 30 sites in each soil. Salt gradients within the soil profiles, together with the total salt concentration and ion ratios, remained relatively constant throughout the growing season. (See also W72-10350) W72-10350

FLOODED RICE SOILS OF NORTHERN AUSTRALIA: II. CHEMICAL PROFILES,

Commonwealth Scientific and Industrial Research Organization, Darwin (Australia). Coastal Plains Research Station. B. G. Williams.

Australian Journal of Soil Research, Vol 10, No 1, p 53-60, March 1972. 9 fig, 11 ref.

Descriptors: \*Soil chemistry, \*Salinity, \*Aquatic soils, \*Rice, Irrigation, Hydrogen ion concentration, Oxidation-reduction potential, Saline soils, Leaching, Australia.

Changes in chemical and electrochemical properties of a flooded calcareous soil sown to rice were monitored during the season of flooding. Considerable variations in specific conductivity, individual cation concentrations, bicarbonate concentration, and carbon dioxide pressures were observed within the soil profile to depths of 30 cm. Redox potential and pH tended to be uniform within a profile except when CaSO4 or H2SO4 was added to the surface soil. Both field and pot experiments showed profile variations in soil properties and the significance of this is discussed in terms of the root distribution of rice. (See also W72-10350) (Knapp-USGS)

WATER REPELLENCE IN SANDY SOILS OF SOUTH-WESTERN AUSTRALIA: II. SOME CHEMICAL CHARACTERISTICS OF THE HYDROPHOBIC SKINS,
Commonwealth Scientific and Industrial Research

Commonwealth Scientific and Industrial Research Organization, Floreat Park (Australia). Div. of Plant Industry.

F. J. Roberts, and B. A. Carbon. Australian Journal of Soil Research, Vol 10, No 1, p 35-42, March 1972. 6 tab, 22 ref.

Descriptors: \*Wettability, \*Soil physical properties, \*Organic matter, Humic acids, Humus, Infiltration, Permeability, Australia. Identifiers: Water repellent soils.

The hydrophobic organic skins on sand grains in water-repellent soils were resistant to removal by solvents such as cold water, concentrated acid, diethyl ether, ethanol, benzene, chloroform, and acetone. Prolonged treatment with hot diethyl ether, ethanol, and benzene removed part of the coating. Treatment with dilute solutions of alkali removed the skin as suspended particles. Com-

pounds within the very stable humic faction of the pounds within the very stable numic faction of the soil organic matter appeared to be mainly respon-sible for water repellence in soils. Deposits of fresh organic materials could also produce water repellent properties. (Knapp-USGS) W72-10354

SEASONAL VARIATIONS IN THE SALT COMPOSITION OF SOME SALINE WATER-IRRIGATED SOILS OF WESTERN RAJASTHAN: I. EFFECT OF RAINFALL, Central Soil Salinity Research Inst., Karnal (In-

I. C. Gupta, and C. T. Abichandani. J Indian Soc Soil Sci. Vol 18, No 4, p 429-435.

1970

Identifiers: Irrigated land, \*Leaching, Rainfall, Rajasthan, \*Salinity, Salt, Seasonal, Sodium, \*Soil chemical properties.

After the rains, amounting to 35 to 45 cm, the high salt concentration was greatly reduced making the surface 40 cm completely non-saline. The hydrolysis of Na-clay appeared to be of small significance and leaching did not result in high alkalinity. On the other hand, in highly calcareous soils, simultaneous with soluble salt removal, the exchangea-ble Na percentage was also reduced to a low level. Surface soils of the Na-Mg-Cl-SO4 type becam Na-Ca-Cl-HCO3 type after rainfall.--Copyright 1972, Biological Abstracts, Inc. W72-10369

RELATIONSHIP BETWEEN WATER TABLE LEVELS AND TYPE OF MOTTLES IN FOUR ONTARIO GLEYSOLS, Department of Agriculture, Edmonton (Alberta).

Department of Agriculture, Edmonton (Alberta). Soil Research Inst. P. H. Crown, and D. W. Hoffman. Can J Soil Sci. Vol 50, No 3, p 453-455, 1970, Illus. Identifiers: Canada, "Gleysols, Moisture, "Mottles, Ontario, Soils, "Water table.

Trends were noted toward more diffuse boundaries and increases in mottle size and abundance with increased duration of saturation of soil horizons. All mottles were prominent. Horizontal banding of mottles occurred in those horizons through which there had been the highest frequency of water table fluctuation. The accumulation of Fe in horizontal bands may have resulted partially from textural differences in the stratified soil material. However, this banding of mottles was not observed where there was no continued fluctuation in depth to water table, even though all soils have developed in stratified materials. Therefore, the banded mottles appeared to be a function of fluctuating water table through a relatively narrow depth range. Vertical streaking of mottles oc-curred in the horizon directly below the Apk through which the water table fluctuated once during the measuring period. Mottles in horizons almost permanently saturated were large, nebulous features (blotches) while those in horizons rarely saturated during the measuring period were generally smaller and had more distinct boundaries with the matrix (spots). The results of this study indicate that form and boundary characteristics of mottles might be useful in a more quantitative appraisal of the moisture status of soils.--Copyright 1972, Biological Abstracts, Inc.

SOIL MOISTURE REGULATION DEVICE, (IN RUSSIAN), V. M. Shalin, L. V. Nitovshchikova, and V. N.

Sudachenko

Zap Leningr S-Kh Inst. Vol 113, p 62-67, 1969. Identifiers: Regulation, \*Soil Moisture Meters, \*Instrumentation

A decrease in the gypsum content of 'gypsum blocks' with metal electrodes did not have any significant effect on their sensitivity. The transducer may be constituted with nonlinear semiconductor resistors (based on silicon carbide). The basic circuit diagram of the device is discussed .-- Copyright 1972, Biological Abstracts, Inc. W72-10408

#### 2H. Lakes

SAMPLING AND DISTRIBUTION OF ANIMALS IN SUBMERGED VEGETATION, (IN CZECH), Karlova Universita, Prague (Czechoslovakia). Dept. of Hydrobiology. J. Korinkova.

Vestn Cesk Spol Zool. Vol 35, No 3, p 209-221. 1971. Illus.

Identifiers: \*Animals, Biomass, Distribution, \*Sampling, Vegetation.

In carp-pond submerged stands a 1-m2 sampler was used for sampling the phytomacrofauna. The mean abundances and biomasses of animals were related to the unit bottom area, to unit plant weight, to the unit plant surface, and to the unit water volume. In animal populations various rela-tions to the plant stand density were found. Distribution of animals was tested and the log-normal distribution was shown for the total bion animals. Three predominant species had different distributions, as influenced by the behavior of the species. An abundant material collected by the large sampler made it possible to treat quantitative data in terms of the normal distribution because of large means. The size of the sampler is also cussed according to the species dispersion and the 'edge effect' of samplers.--Copyright 1972, Biological Abstracts, Inc. W72-09834

ON THE QUESTION OF THE INTRODUCTION OF PURIFIED WASTE WATER IN LAKES, Eidgenoessische Technische Hochschu Kastienbaum (Switzerland). Hydrobiology Lab. For primary bibliographic entry see Field 05C.

THE ALGAE FROM A MODEL POND OF THE M. NENCKI INSTITUTE OF EXPERIMENTAL BIOLOGY,

Jagellonian Univ., Krakow (Poland). Dept. of

Hydrobiology. H. Wysocka-Bujalska, and K. Starmach. Pol Arch Hydrobiol. Vol 17, No 4, p 526-530. 1970.

Identifiers: Achroonema macromeres. onema simplex, \*Algae, Clathrochloris hannae, Microcystis testacea, Pelonema aphane, Poland, \*Pond, Records, Species, Tetrachloris diplococcus, Tetrachloris merismopedioides.

A list of algae occurring in the model pond is given. Clathrochloris hannae sp. nov. is described. New records for Poland are: Microcystis testacea, Tetrachloris merismopedioides, T. diplococcus, Achroonema macromeres, A. simplex and simplex Pelonema aphane .-- Copyright 1972, Biological Abstracts, Inc.

A MODEL FOR A LINKED SYSTEM OF MUL-TI-PURPOSE RESERVOIRS WITH STOCHASTIC INFLOWS AND DEMANDS, TexasA and M Univ., College Station. Water Resources Inst. G. L. Curry, J. C. Helm, and R. A. Clark.

Available from the National Technical Information Service as PB-210 196, \$3.00 in paper copy, \$0.95 in microfiche. Texas Water Resources I stitute Technical Report No 41, June 1972. 57 p, 3 fig, 3 tab, 9 ref. OWRR A-019-TEX (1).

Descriptors: \*Multiple-purpose reservoirs, \*Model studies, \*Inflows, \*Stochastic processes, reservoirs. Statistical methods, Computers, Input-output analysis, Reservoir operation, Forecasting, Water Experiments were conducted with models of single and linked systems multi-purpose reservoirs with stochastic inflows. The objective of the first study was to develop an optimal operating policy for a given time sequence of minimum and max-imum reservoir levels. The approach is based on the distribution of the sum of the inflows over successive time periods. The resultant reservoir release variables are no longer stochastic values. The resultant constraint set forms a linear system of equations. Stochastic demands as well as in-flows are considered. The model with stochastic inflows was extended to a connected system of reservoirs. The reservoirs were considered to be linked by a system of pumping canals and normal river reaches. The objective was the optimal operation of the total system subject to certain restrictions on reservoir operations. The linked system model is a natural extension of the single reservoir model. The resulting constraints for the problem are linear and the decision variables are deterministic rather than random variables. Thus, linear, quadratic or even general convex objective functions can be handled readily. (Woodard-USGS) W72-09889

THE COMPARISON OF TOTAL MERCURY LEVELS IN RAINBOW TROUT (SALMO GAIRDNERI) FROM AN OLIGOTROPHIC LAKE AND AN EUTROPHIC LAKE, Michigan State Univ., East Lansing. Inst., of Water Research. For primary bibliographic entry see Field 05C. W72-10063

A DIFFUSION MODEL FOR GREEN BAY, LAKE MICHIGAN, Wisconsin Univ., Madison. Marine Studies Center. For primary bibliographic entry see Field 05C. W72-10077

FRESHWATER ECOLOGY IN THE MATO GROSSO, CENTRAL BRAZIL. II. ASSOCIATIONS OF CLADOCERA IN MEANDER LAKES OF THE RIO SUIA MISSU, Westfield Coll., London (England). Dept. of Zoology. For primary bibliographic entry see Field 05C. W72-10082

FRESHWATER ECOLOGY IN THE MATO GROSSO, CENTRAL BRAZIL. III. ASSOCIA-TIONS OF ROTIFERA IN MEANDER LAKES OF THE RIO SULA MISSU, Westfield Coll., London (England). Dept. of Zoology. For primary bibliographic entry see Field 05C. W72-10083

THE FERTILIZATION OF GREAT CENTRAL LAKE. I. EFFECT OF PRIMARY PRODUC-TION, Fisheries Research Board of Canada, Nanaimo (British Columbia). Biological Station. For primary bibliographic entry see Field 05C. W72-10093

THE FERTILIZATION OF GREAT CENTRAL LAKE. II. ZOOPLANKTON STANDING STOCK, Fisheries Research Board of Canada, Nanais (British Columbia). Biological Station. For primary bibliographic entry see Field 05C. W72-10094

PHYSICAL AND CHEMICAL LIMNOLOGY OF THE LAKES OF MANITOULIN ISLAND, Toronto Univ. (Ontario). Dept. of Zoology. H. H. Harvey, and J. F. Coombs. Journal Fisheries Research Board of Canada, Vol. 28, No. 12, p 1883-1897, 1971. 7 fig, 3 tab, 22 ref.

# Group 2H-Lakes

Descriptors: \*Limnology, \*Lakes, \*Physical properties, \*Chemical analysis, Fish, Trenches, Sediments, Temperature, Oxygen, Hydrogen ion concentration, Magnesium, Calcium, Sodium, Potassium, Dolomite, Lake morphometry.

Identifiers: \*Canada, \*Manitoulin Island (Ontention) Letholton: \*Landada, \*Manitoulin Island (Ontention) Letholton: \*Landada, \*Manitoulin Island (Ontention) Letholton: \*Landada, \*Landada,

tario), Lake bottom trenches.

The Manitoulin Island lakes of Ontario, Canada ne mantoum island iskes of Ondario, Canada were analyzed to define physical and chemical lake characteristics lying within dolomitic masses, provide explanation for trenches in many lake basins, explain fish survival in shallow lakes, and basins, explain this sufficient was an analysis of fish and zooplankton zoogeography. The lakes were classed by frequency of circulation as dimictic or polymictic; polymictic lakes were classed as those with or without trenches, and as shallow or deep. The lake bottom trenches may be maintained by wind-induced water currents. In one trenched lake, winter oxygen declined to less than 1 ppm before surface melt-water entered under the ice sheet. Winter kills of fish such as yellow perch and northern pike were observed in three lakes, but presence of older age-classes of fish suggested that extensive winter kills are not common. Fish survive in the shallow lakes due to continued presence of at least small amounts of oxygen in winter and the timely arrival of surface melt-water under the ice. Most lakes had a high pH and were rich in magnesium relative to calcium consistent with dolomitic bedrock. Sodium and potassium occurred at unusually low concentrations. (Jones-

PALEOLIMNOLOGY OF LAKE TEXCOCO, MEXICO. EVIDENCE FROM DIATOMS, Minnesota Univ., Minneapolis. Limnological Research Center.

J. P. Bradbury. Limnol Oceanogr. Vol 16, No 2, p 180-200. 1971.

Illus. Map.
Identifiers: Anomoeoneis costata, Campylodiscus clypeus, Cyclotella quillensis, Cyclotella striata, Denticula elegans, \*Diatoms, Lakes, \*Limnology, Mexico, Nitzschia frustulum, Stephanodiscus niagarae, \*Lake Texcoco.

46-m core from the lacsutrine sediments beneath Mexico City was analyzed to establish a strati-graphic sequence of diatom assemblages for use in interpreting the climatic and limnologic history of ancient Lake Texcoco. Diatoms were found in nearly every 20-cm sample interval, and several major zones were established. Planktonic and benthonic-epiphytic assemblages alternate throughout the core, both of fresh- and brackishwater types. The alternations reflect the fact that the coring site is marginal to the main basin of the lake, and limnologic conditions change as water levels rise and fall. A freshwater planktonic as-semblage dominated by Stephanodiscus niagarae in deeper parts of the core indicates that a la cool, and possibly deep lake existed about 100,000 yr ago, either because of pluvial or because of tectonic factors. This is replaced (depth 35 to 30 m) by a freshwater benthonic-epiphytic assemblage characterized by Denticula elegans and other marsh diatoms. The marshes were probably maintained by springs from the shore when the lake was reduced to saline pools in the center of the was reduced to same pools in the center of the basin. As water levels rose again (core depths 30 to 5 m), brackish water flooded the marshes, and brackish benthonic diatoms (such as Anomoeoneis costata, Campylodiscus clypeus, and Nitzschia frustulum) replaced the earlier floras. These were periodically replaced by brackish planktonic diatoms (as Cyclotella striata and Cyclotella quilensis) when the lake was deeper, but the earlier freshwater planktonic flora never recurred. The same brackish planktonic and benthonic diatoms that prevailed for several tens of thousands of years are found today confined to the brackish years are found today confined to the brackish pools of Lake Texcoco that are remnants of the former larger lake. The long interval of fluctuating brackish floras probably represents Wisconsin time. The last 10,000 yr of the lake's history is marked by a return of the marsh flora, suggesting a climate drier than that of Wisconsin time. A marked climatic change, however, is not necessary to explain this last change in the diatom flora, and it seems likely that the pluvial climate inferred for the southwestern USA had less effect at the atitude of Mexico City (19 deg 30) than farther north.--Copyright 1972, Biological Abstracts, Inc. W72-10121

CHEMICAL EXCHANGES BETWEEN SEDI-MENTS AND WATER IN THE GREAT LAKES: SPECULATIONS ON PROBABLE REGULATO-RY MECHANISMS.

Wisconsin Univ., Milwaukee. Center for Great Lakes Studies For primary bibliographic entry see Field 05C.

W72-10158

THE LOCAL EFFECT OF A PUNCTATE WASTE WATER LOADING OF A STANDING BODY OF WATER; A DIRECT DETERMINATION OF THE GROWTH LIMITING EFFECT OF PHOSPHORUS IN LAKE LUCERNE, Eidgenoesische Technische Hochschule, Kastienbaum (Switzerland). Hydrobiology Lab. For primary bibliographic entry see Field 05C. W72-10205

THE RELATIONS BETWEEN THE REED STANDING-CROP AND FISHERY EFFECT, Polish Academy of Sciences, Warsaw. Inst. of Pons.. Ecology.

Pol Arch Hydrobiol, Vol 17, No 3, p 363-371, 1970,

Identifiers: Bream, Fishery, Pike, \*Reed, Tench, \*Lakes, \*Poland, \*Fish populations.

The dependence between the reed standing-crop, size of littoral and the catches of some fish species was analyzed. The investigations included 53 lakes of the Mazurian Lakeland. Reed production had no significant effect on fishing production. However, a significant dependence was observe between the percentage participation of the littoral and the catches of tench and pike (positive dependence) and bream (negative dependence).--Copyright 1971, Biological Abstracts, Inc.
W72-10215 72-10215

ON THE VARIATION IN DIRECTION OF THE HORIZONTAL COMPONENT OF REMANENT MAGNETISATION IN LAKE SEDIMENTS, Freshwater Biological Association, Ambleside (England). For primary bibliographic entry see Field 02J. W72-10253

PEATLAND TYPES AND THEIR REGIONAL DISTRIBUTION IN SOUTH SWEDEN, For primary bibliographic entry see Field 05C. W72-10308

A COMPARATIVE MICROBIOLOGICAL STUDY OF THE SAPROPELS OF LAKES AKACH-KUL' AND SABANAI IN CHE-LYABINSK OBLAST. (IN RUSSIAN), For primary bibliographic entry see Field 05C. W72-10388

A MICROBIOLOGICAL AND SANITARY-BA-CTERIOLOGICAL CHARACTERIZATION OF THE SAPROPEL OF LAKE BOLYASH, CHE-LYABINSK OBLAST, (IN RUSSIAN), For primary bibliographic entry see Field 05C. W72-10393

A GEOLOGIC GEOCHEMICAL AND SEDI-MENTOLOGIC STUDY OF FLATHEAD LAKE. MONTANA, Montana State Univ., Bozeman. Water Resources A. Silverman.

Available from the National Technical Information Service as PB-210 588, \$3.00 in paper copy, \$0.95 in microfiche. Montana Water Resources

Research Center Completion Report No. 21 (1972). 48 p, 3 fig, 1 tab, 28 ref. Project No. OWRR A-019-MONT (1).

Descriptors: \*Geologic investigations, \*Geology, \*Geophysics, \*Geological surveys, \*Structural geology, \*Gravity studies, Lakes, Montana. Identifiers: Flathead Lake (Mont).

In order to interpret the structure and geology of the Flathead Lake region in Montana, a combination gravity survey and reconnaissance geologic map were completed. The gravity survey covers over 800 square miles around Flathead Lake while the geologic map covers 300 square miles west of the southern part of the lake. Flathead Lake marks the trend of the Rocky Mountain Trench in the study area. In the area studied, lows are located within Flathead Lake and to the south of it. These lows are interpreted as part of a series of structural basins filled with 3000 to 5000 feet of low density valley fill. The southwest side of Flathead Lake is highly faulted with several small basins and one major negative gravity anomaly centered over Irvine Flats. The Big Draw fault is believed to be resaled to major east-west lineaments south of the study area. The fault, based on gravity data, appears to have been downdropped into the Rocky Mountain Trench. Minor faulting is still active along the trend of the Rocky Mountain Trench. (Holje-Montana)
W72-10433

FISHCULTURE SURVEY REPORT FOR WEST CENTRAL AFRICA. INCREASING FISH PRODUCTION BY IMPROVED FISHCUL-

Auburn Univ., Ala. For primary bibliographic entry see Field 08I. W72-10436

#### 2I. Water in Plants

METHODS FOR DETERMINING WATER AC-TIVITY (SUCTION STRENGTH) IN PLANT TIS-SUES, Moscow State Univ. (USSR).

I. I. Sudnitsyn, Y. A. Davydova, and I. A. Kalileeva.

Biol Nauk. Vol 14, No 1, p. 123-126. 1971. Illus. Identifiers: \*Analytical techniques, Pine needles, Plants, Psychrometry, \*Plant tissues.

The results of measuring water activity in a pine needle by the psychrometric method (according to the relative pressure of the water vapor) and by the method of equilibrium with a sucrose solution are compared. When suction strength is more than 15 atm, the psychrometric method yields higher values than the method of equilibrium with solutions. The possible reasons for this phenomenon are discussed.—Copyright 1972, Biological Ab-

MINATION OF ALKALI SACATON (SPOROBO-LUS AIROIDES TORR.) AT VARIOUS MOISTURE STRESSES, Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.

O. D. Knipe.

Bot Gaz. Vol 132, No 2, p 109-112. 1971. Illus. Identifiers: Carbowax, "Germination, Mannitol, "Moisture stresses, "Osmotica, Sacaton M, Sporobolus airoides M.

The moisture-limiting ability of aqueous solutions of mannitol, Carbowax 200, and Carbowax 4000 was tested at moisture tensions ranging from 0.3 through 15.0 atm. Carbowax 4000 was the osmoticum that reduced seed permination at 3.0

atm over that at 0.3 atm. Germination of seeds atm over that at 0.3 atm. Cetalmands of seeds treated with Carbowax 200 was less at 8.0, 12.0, and 15.0 atm than that of seeds treated with mannitol and carbowax 4000, but there were no differences in germination of seeds treated with the latter 2 osmotica at these tensions. There were no differences in % of germination among any of the osmotica at 0.3 and 3.0 atm.—Copyright 1972, Biological Abstracts, Inc.

WORLDWIDE DISTRIBUTION AND ECOLOGY OF EURYCERCUS AND SAYCIA OF EURYCERCUS AND SAYO (CLADOCERA), Indiana Univ., Bloomington. Dept. of Zoology.

Limnol Oceanogr. Vol 16, No 2, p 254-308. 1971.

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Identifiers: \*Cladocera, \*Distribution, \*Ecology, Eurycercus, Eurycercus glacialis, Eurycercus lamellatus, Eurycercus polyodontus, Saycia, lamellatus, Saycia cooki.

The 2 spp. of Eurycercus are largely allopatric in the Northern Hemisphere, glacialis tending to be peripheral in distribution in the far north, occurring only as far south as 51-52 deg. N. There are vigorous disjunct populations of unknown history in oligotrophic heath and dune localities in Denmark and the Netherlands. The center of dis-tribution is Greenland-Iceland. E. lamellatus is widely distributed over North America south to Mexico City and over much of Eurasia south to Algeria and southern Tibet. It also is known from farther north than glacialis. It is the only species occupying the large mountain masses of the Northern Hemisphere. The center of distribution seems to be western Europe. Co-occurrence of the 2 spp. in the same water bodies is known only for a few scattered lakes in Denmark, northern Sewden, Iceland, and Alaska. E. lamellatus also occurs as Iceland, and Alaska. E. lamellatus also occurs as disjunct populations in Argentina and South Africa, but not at comparable latitudes in Australia and New Zealand. Here, S. cooki occurs, which might be considered an ecological equivalent of E. lamellatus except that it is confined to temporary water bodies. The finding of 3 males of Saycia from Australia-the first males ever recorded-timulated adstable and the morphology of stimulated a detailed study of the morphology of the species and a comparison with Eurycercus. Retention of the 2 genera in separate subfamilies seems justified. The male of Saycia is unique among chydorid Cladocera in having a plumose sexual seta on the antennule and in having the post-abdominal claw spatulate at the tip. The sperm ducts open near the tip of the post-ab-domen, rather than at the base as in Eurycercus, the latter condition being unique among the chydorids. Saycia from New Zealand differs from the population in Australia chiefly in having more preamal teeth on the postablomen and in being higher and having a shorter posterior margin relative to length of the animal. All these characters change with size. These regressions are presented and their significance discussed. The New Zealand population has been designated a new geographic subspecies, pending the eventual recovery of males. The number of postabdominal teeth in E. lamellatus increases with increasing size, making it likely that the species described as E. polyodontu merely represents individuals from the upper end of this regression. The number of teeth in E. glacialis is smaller than in lamellatus and does not increase with size of animal. The variability of tooth number within each species is so great that the number 100 proposed in the past cannot be used to separate the 2 spp. with any reliability. Similarly, the subspecies of Saycia from New Zealand has a larger toth number, which shows a marked increase with size of animal, than that from Australia.—Copyright 1972, Biological Abstracts, Inc. W72-09928

WATER POTENTIAL GRADIENT IN A TALL SEQUOIADENDRON, Union Coll., Schenectady, N. Y. P. Tobiessen, P. W. Rundel, and R. E. Stecker.

Plant Physiology Vol 48 No 3 p 303-304, 1972, Il-

Identifiers: Gradient, \*Water potential, Pressure, Psychometer, \*Sequoiadendron, Thermocouple, \*Water transport, Xylem.

With an elevator installed in a 90-meter tall Sequoiadendron to collect the samples, xylem pressure potential measurements were made approximately every 15 m along 60 m of the tree's height. The measured gradient was about -0.8 bar per 10 meters of height, i.e., less than the hydrostatic gradient. Correction of the xylem pressure potential data by calibration against a thermocou-ple psychrometer confirmed this result. Similar gradients are described in the literature in tall conifers at times of low transpiration, although a different sampling technique was used. If the data in the present study and those supporting it are typical, they imply a re-evaluation of either the use of the pressure chamber to estimate water potential or the present theories describing water transport in tall trees.--Copyright 1972, Biological Abstracts, Inc. W72-09935

EFFECT OF EXTRACTS FROM DRY LEAVES OF TREES ON THE WATER-ABSORBING CAPACITY AND FRACTIONAL COMPOSI-TION OF THE WATER OF PLANT TISSUES, (IN RUSSIAN), Voronezhskii Lesotekhnicheskii Institut (USSR).

V. D. Roshchina.

Biol Nauk. Vol 13 No 12 p 63-68. 1970. Illus. Identifiers: \*Absorbion, Birch-D, Capacity, Cherry-D, Composition, Cotinus-D, Disorder, Dry, Extracts, \*Leaves, Mountain ash D, Oak-D, Permeability, Plants, Poplar-D, Resistance, Rhus-Typhin-a-D, Sumac-D, Tissues, Tonoplast, \*Trees.

Aqueous extracts from dry leaves lowered the capacity of living plant tissue to absorb water. This was the result of disorders in the semi-permeability of the tonoplast (due to the influence of the ex-tract from the leaves of birch, smoke tree (Cotinus), stage-horn sumac (Rhus Typhina)) or the result of the osmotic resistance of plant extracts (from the leaves of mountain ash, bird cherry, poplar and oak). Changes in the fractional com-position of the water at first were evident mainly by an increase in the portion of the most weakly retained fractions of water and then by a decrease in the portion of these fractions.--Copyright 1972, Biological Abstracts, Inc. W72-09936

DIURNAL CHANGES OF WATER SATURA-TION DEFICIT IN LEAVES AND THEIR DE-PENDENCE ON THE CLIMATIC FACTORS, (IN POLISH), Warsaw Univ. (Poland). Inst. of Botany.

J. Czerski, and M. Wasik.

Acta Soc Bot Pol. Vol 40 No 1 p 41-56 1971. Illus.

(English summary).
Identifiers: Beta D, Brassica D, Calendula D, Climate, Water deficit, Dependence, Digitalis-D, \*Diurnal, \*Leaves, Nicotiana-D, Saturation, Suc-

Daily changes in water suction deficit in different pany changes in water section certain further and species of Nicotiana, Digitalis, Calendula, Beta and Brassica were studied. Significant water deficit in the middle of the day was demonstrated for all plants studied.--Copyright 1972, Biological Abstracts, Inc. W72-09937

STOMATAL MOVEMENTS, FREQUENCIES, AND RESISTANCES IN TWO MAIZE VARIETIES DIFFERING IN PHOTOSYNTHETIC

CAPACITY, Connecticut Agricultural Experiment Station, For primary bibliographic entry see Field 03F.

THE STABILITY OF WATER UNDER TENSION IN THE XYLEM, California Univ., Riverside. Dept. of Soils and

Plant Nutrition.

Z Pflanzenphysio!. Vol 65 No 3 p 195-209. 1971. Il-

Identifiers: \*Bubbles, \*Cohesion theory, Column, Formation, Fracture, Stability, Tension, \*Xylem.

The xylem fluid under tension is in a metastable state but the transfer to the more stable state by bubble formation is impeded by a high free energy barrier unless the tensions exceed 1000 bars. Bubble formation that causes fracture of water columns in the xylem can occur at lower tensions if suitable nuclei are present. Since functional xvlem vessels usually remain filled with solutions from the beginning, and since the transpiration water that passes through them is filtered when entering nuclei for spontaneous bubble formation are absent in the xylar fluid. Creation of nuclei with energy from nuclear radiations is unlikely. Pore sizes in vessel walls are sufficiently small to sustain tensions in excess of 100 bars. Dissolved air in the sap has little effect on the fracture of water columns, under usual conditions, is improbable. Bubble formation is a critical aspect of the cohesion theory for the ascent of sap in plants.—Copyright 1972, Biological Abstracts, Inc. W72-09939 liquids. It is concluded that the fracture of xylar

VERTICAL MOVEMENT OF ACARINA UNDER

MOISTURE GRADIENTS,
Forest Service (USDA), Research Triangle Park,
N.C. Forest Science Lab. L. J. Metz.

Pedobiologia. Vol 11, No 3, p 262-268. 1971. Illus. \*Moisture, \*Movement, Oribatula tibialis, Trhypochthonius americanus.

A laboratory experiment, concerned with survival and movement of mites under different moisture regimes, is described. Groups of mites, as well as 7 spp. of Oribatei moved between mineral soil and organic layers as moisture conditions changed. The Mesostigmata group had a better survival rate than either Oribatei or Trombidiformes. Of the oribatid species studied, Oribatula tibialis, Trhypochthonius americanus, and Caleremaeus sp. had the best survival rates.--Copyright 1972, Biological Abstracts, Inc. W72-10022

EFFECTS OF DRYING AT THREE TEMPERA-TURES ON CARBON DIOXIDE EXCHANGE OF CLADONIA RANGIFERINA (L.) WIGG Wisconsin Univ., Madison. Dept. of Botany.

Photosynthetica. Vol 5, No 2: p 124-127. 1971. Il-

Identifiers: \*Cladonia rangiferina, Drying, Exchange, Carbon dioxide, \*Photosynthesis, Pinus banksiana G, \*Respiration, \*Temperatures.

The effects of the hydration level of C. rangiferina on net photosynthesis and dark respiration, at 3 temperatures, are reported for a population from the Wisconsin pine barrens (Pinus banksiana).— Copyright 1972, Biological Abstracts, Inc. W72-10061

BIPHASIC CHARACTER OF CHANGES IN THE VISCOSITY OF PROTOPLASM OF PLANT CELLS UNDER CONDITIONS OF WATER DEFICIENCY, (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Inst. of Plant Physiology.
V. N. Zholkevich, and M. N. Grigor'eva.
Dokl Akad Nauk SSSR Ser Biol, Vol 196, No 3, p717-718.1971. Illus.
Identifiers: Aggregation. \*Plant cells. Chloroplast

Identifiers: Aggregation, \*Plant cells, Chloroplast, \*Cucumber-D, Death, \*Water deficiency, Hypocotyl, Protoplasm, \*Viscosity.

#### Group 21-Water in Plants

The response of parenchyma cells protoplasm of cucumber hypocotyls to progressive dehydration had a pronounced biphasic character: at first the viscosity dropped and then it increased, i.e., on passing from the first phase to the second the sign of the response changes to the opposite direction. The increase of viscosity continued until the cells died, which was usually accompanied by chloroplast aggregation. If severely wilted plants having a very high viscosity were watered, the viscosity again decreases, which shows that the increase of viscosity was reversible.--Copyright 1972, Biological Abstracts, Inc. W72-10147

INVESTIGATION OF THE WATER STATUS IN PLANT TISSUES BY THE NUCLEAR-SPI-N-ECHO METHOD (IN RUSSIAN), Kazan Agricultural Inst. (USSR).

F. D. Samuilov, E. A. Nikiforov, and V. I.

Dokl Akad Nauk SSSR Ser Biol., Vol 196, No 3, p 723-726, 1971.

Identifiers: \*Bound water, \*Corn-M, Free water, \*Plant tissues, Ratio, Roots.

An investigation of the proton spin-lattice relaxa-tion time in tissues of corn roots made it possible to distinguish 2 different fractions of water: bound, which apparently forms a single structure with the remaining components of the cytoplasm and free, which is similar in its status to water in vitro. The ratio of these water fractions changes in different plant tissues. The 2 spin-lattice relaxation times (for free and bound water) were not determined experimentally in all organs. This indicates considerable differences in the water status in individual plant organs and tissues.--Copyright 1972, Biological Abstracts, Inc. W72-10150

THE SEASONAL EMERGENCE OF SOME EPHEMEROPTERA OF A STREAM IN THE LAURENTIDE MOUNTAINS (CANADA), Montreal Univ. (Quebec). Dept. of Biological

Sciences.

F. Harper, and E. Magnin. Can J Zool. Vol 49 No 9 p 1209-1221. 1971. Illus. English summary.

Identifiers: Canada, Climate, Dimorphism, \*Emergence, \*Ephemeroptera, Laurentide Mountains, \*Seasonal, Streams.

Six emergence traps set up in a stream permitted the discovery of 2 types of seasonal emergence in Ephemeroptera: one very short and synchronized (type 1) and the other more gradual and dispersed (type 2). Unfavorable climatic conditions some effect on an emergence of the second type but none on an emergence of the first type. The emergence pattern is usually similar at all stations and the males emerge before the females.--Copy-right 1972, Biological Abstracts, Inc. W72-10167

PHOTOPERIODIC ACTIVITY CHANGES IN JUVENILE SOCKEYE SALMON (ONCO-RYHYNCHUS NERKA), California Univ., San Diego, La Jolla. School of

I. E. Byrne

Can J Zool. Vol 49, No 8, p 1155-1158. 1971. Iilus. Identifiers: Oncoryhynchus nerka, \*Photoperiodic activity, \*Salmon.

Spontaneous locomotor activity was studied in juvenile sockeve salmon under controlled environmental conditions (LD (light dark) 9.5: 14.5 or 12:12; 5 deg. C; 0.1-34.4 lux). Siblings were hatched in activity chambers and swimming movements were monitored with an ultrasonic system for 11 mo. The experiments gave evidence of a bimodal activity rhythm in sockeye fry immediately after hatching. The bimodal, dark-active pattern persisted until 9 days after the fish emerged from the gravel. The photobehavioral response was reversed and the fish expressed a unimodal, lightactive pattern 10-14 days after first emergence. This light-active response was then maintained for 11 mo. The possible interrelationships between age, photobehavioral response, and activity rhythms underlying the sockeye fry migrations to nursery lakes are discussed.—Copyright 1972, Biological Abstracts, Inc.

DISTRIBUTION OF INVERTEBRATES IN A HIGH MOUNTAIN BROOK IN THE COLORADO ROCKY MOUNTAINS, Oslo Univ. (Norway). Zoological Lab.

K. Elgmork, and O. A. Saether. Univ Colo Stud Ser Biol, Vol 31, p 3-55, 1970, Illus, Maps.

ids, maps.
Identifiers: Boreoheptagyia-Sp, Brook, Car-diocladius-Sp, Cinygmula-Mimus, Colorado, Diamesa-Sp, Distribution, Ephemerella-Coloradenais, Eukiefferiella-Sp, High, Invertebrates, Micropsectra-Sp, Mountain, Mountains, Prosimulium-Esselbaughi, Rocky, Thaumalea-Sp,

The midsummer distribution of invertebrates in North Boulder Creek in Colorado was studied from the brook's source in a snowbank at about 3800 m above sea level down to near the timberline at about 3300 m. The brook is a typical high mountain brook with a small water volume and a rapid current. The temperature of the water in July, varied from slightly below 1 deg C near the snowbank to about 10 deg in the lowest part. The brook can be divided into 4 zones based on the distribution of the fauna. The clearest break is at Green Lake 3 at a temperature of about 5 deg. This is a limit for many species, either downwards or up-wards. Another clear zonal boundary is conwards. Another clear zonal boundary is con-stituted by Green Lake 5 where the temperature drops to 1 deg. Of the various invertebrates, the chironomids are the most abundant both in number of individuals and species. The second most abundant group is the simuliids. The other groups are relatively far less numerous. The lar-gest number of individuals was generally found in the middle part of the brook, while the number of species showed an increasing trend downwards There was a relative increase in the number of chironomids within each zone going up the brook, and in the simuliids and Ephemeroptera going down. The community of a tributary brook was most closely related to that of the corresponding part of the main brook at the same elevation. The community of chironomids corresponds closely to those in the system of Thienemann (1954). Many species and genera gave closely related or identical forms in other high mountain areas of the world. The length distribution is given for some of the more abundant forms. Slower development in the colder, upper parts and at stations close to snow banks is clearly indicated in most of the species. In Eukiefferiella sp. of the minor group and probably also in Cardiocladius sp., there seem to be 2 generations a year in the lower stretches of the brook, 1 generation a year in the upper. In Prosimulium esselbaughi there may be a 2-yr cycle at the upper stations, a 1-yr cycle in the lower reaches. A 2-yr cycle is indicated in Ephemerella coloradensis and Cinygmula mimus. All species from the creek belong to the moss fauna, or to the stone fauna. A few species, however, such as Pseudostenophylax edwardsi, Thaumalea sp., Boreoheptagyia sp., and Micropsectra sp., seem to belong to the hygropetric fauna of the stones. The majority of types and groups of species and genera found are members of the Holarctic fauna. Most, however, are probably not identical to European species. Pairs of species and larger species groups are well-known among boreo-alpine forms. The majority of chironomids in the area belong to such groups but seem to have been isolated for a longer time from their relatives in Europe than these re tives have been separated from each other. The Rocky Mountains create a continuous bridge from north to south. Forms, which in Europe would be-long to the species from northern glacial margins, from southern glacial margins, or to the boreo-alpine groups, are therefore sympatric in the Rocky Mountains.--Copyright 1972, Biological Abstracts, W72-10394

NOTES ON BIOLOGICAL ASPECTS OF OYSTERS, Universidad de Oriente, Cumana (Venezuela).

Inst. of Oceanography. J. B. Ruiz.

Lagena. Vol 23/24, p 48-68, 1969, Illus. Identifiers: Crassostrea rhizophorae, Cultivation, \*Habitat, \*Oysters, Rhizophorae mangle D, \*Tax-

The family of the Ostreidae contains many species, both edible and inedible. Its distribution is limited to a broad fringe along the coasts within latitudes 64 deg N and 44 deg South. Questions of taxonomic differentiation are explored. The species of edible oyster predominant along the Venezuelan coast is Crassostrea rhizophorae (Guilding), clusters of which are attached to the areal roots of Rhizophorae mangle. Numerous other species are described and the extent of their habitat discussed. Their taxonomic and morphologic position is dealt with, and their nutritaxonomic and tion and reproduction are examined. Reproductive life and cultivation are studied.--Copyright 1972, Biological Abstracts, Inc. W72-10396

## 2J. Erosion and Sedimentation

METHOD AND APPARATUS FOR PREVENT-ING EROSION, Gray Tech Industries, Inc., Mohnton, Pa.

For primary bibliographic entry see Field 04D. W72-09795

TEXTURAL VARIATION IN SUB-ENVIRONMENTS OF THE SHALLOW-WATER WAVE ZONE, KOUCHIBOUGUAC BAY, NEW BRUN-

Toronto Univ. (Ontario). Dept. of Geography; and Scarborough Coll., Toronto (Ontario). Dept. of Geography. For primary bibliographic entry see Field 02L. W72-09857

WISCONSINIAN. LATE ICE-WEDGE POLYGONS NEAR KITCHENER, ONTARIO, CANADA, Waterloo Univ. (Ontario). Dept. of Earth

A. V. Morgan.

Canadian Journal of Earth Sciences, Vol 9, No 6, p 607-617, June 1972. 9 fig, 1 tab, 35 ref.

Descriptors: \*Glaciation, \*Canada, \*Glacial sediments, \*Pleistocene epoch, \*Sedimentary struc-tures, Glacial soils, Glacial drift, Geomorphology. Identifiers: \*Ontario, \*Polygonal ground.

Fourteen areas of polygonal ground were observed in the summer of 1971 in the area east of Kitchener, Ontario. Examination of vertical air photographs taken in 1955 and 1963 revealed eighteen additional areas of polygons nearby. A trench section cut through an area of polygons revealed wedge-shaped sand and gravel infilled structures believed to be icewedge casts. The polygonal ground is developed upon Port Stanley II Till west of the Paris Moraine and was deposited between 14,000 and 13,500 years B.P. The periglacial ended by 13,000 years B.P. The air tempera-ture of the Kitchener region during formation of the icewedges was probably 25 deg F cooler than at present. A tundra environment may have existed from the period of ice retreat until the cessa-tion of periglacial activity. (Knapp-USGS)

# Erosion and Sedimentation—Group 2J

**QUANTIFICATION OF LIMESTONE EROSION** IN INTERTIDAL, SUBARIAL AND SUBSOIL ENVIRONMENTS, WITH SPECIAL REFERENCE TO ALDABRA ATOLL, INDIAN

OCEAN, Bristol Univ. (England). Dept. of Geography.

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ex. SaCave Research Group of Great Britain Transac-tions, Vol 14, No 2, p 176-179, March 1972. 18 ref.

Descriptors: \*Erosion, \*Limestones, \*Karst, \*Atolls, Indian Ocean, Leaching, Water chemistry, Carbonate rocks, Solubility, Weathering, Tropical regions, Sea water. Identifiers: \*Aldabra atoll.

Erosion rates of limestone were studied on an atoli in the Indian Ocean by using micro-erosion me-ters, measurements of carbonate saturation, direct weight loss of pre-weighed tablets, and growth rates of boring mollusks. Terrestrial erosion rates are related to lithology, high-magnesium calcites and aragonites being the most soluble and the most eroded. Selective solution of these minerals is possible in sea water, but solution is less than abrasion and biological action, except in the peaty mangrove waters. Erosion rates increase with ex-posure, from 1 mm/yr on a N.W. facing coast to 3 mm/yr on exposed S.E. facing coast. Terrestrial rates average at about 0.3 mm/yr. (Knapp-USGS) W72-09860

HYPOTHESES OF KARST LANDFORM DEVELOPMENT IN JAMAICA,

Bristol Univ. (England). Dept. of Geography. D. I. Smith, D. P. Drew, and T. C. Atkinson. Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 159-173, March 1972. 9 fig, 5 tab, 19 ref, append.

Descriptors: \*Karst, \*Geomorphology, \*Water chemistry, \*Laterites, \*Mathematical models, Translocation, Erosion, Sedimentation, Leaching, Weathering, Tropical regions. Identifiers: \*Bauxite, \*Jamaica.

The geology and superficial deposits of the White Limestone areas of central Jamaica are described.

The karst landforms are divided into major groups referred to as cockpit karst, degraded cockpit karst, and interior valleys. The bauxitic superficial deposits and their relation to the underlying limestone are described. An account is presented of the hydrological behavior of the differing karst types, the groundwater flow, and the rates of solu tion for various sites within the limestone. A qualitative model accounts for the origin of the bauxite deposits and of the degraded karst. The bauxite deposits are a weathering residuum of the limestone, transported through the groundwater system from sites of erosion in the cockpit karst. A reasonable agreement between model and real landforms is achieved. Estimates of the time required to attain steady state conditions in the model accord with independent estimates of the minimum age of the Jamaican bauxite deposits. (Knapp-USGS) W72-09862

PROBLEMS OF THE DISSOLUTION OF DOLOMITIC ROCKS (PROBLEMES DE LA DISSOLUTION DES ROCHES DOLOMITIQUES), Aix-Marseille Univ. (France). Institut de Geogra-

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 125-131, March 1972. 5 fig, 1 tab, 10 ref.

Descriptors: "Erosion, "Dolomite, "Karst hydrology, "Geomorphology, Water chemistry, Diagenesis, Weathering, Carbonate rocks, Geochemistry, Mineralogy, Porosity, Permeabili-

The petrographic characters of dolomitic rocks, such as their crystalline texture and unequal porosity, are described in relation to the variable conditions of diagenesis. These two characters vary with the magnesium content. The results of analyses of rainwash water in a dolomitic area and of percolating water through a dolomitic bed in the Etoile Mountain are presented. Study of waters in large dolomitic areas demonstrates the frequency od circulation of waters of phreatic type, with solute contents higher than they are in similar calcareous areas. High residual features or enclosed depressions appear to be the results of an unequal corrosion of dolomites by such waters. Tors and castellated forms are etched into relief by the removal of dolomite detritus; their subserial removal of dolomite detritus; their subar development is a remodelling. (Knapp-USGS) W72-09867

MERITS OF A HYDROLOGICAL BIAS TO KARST EROSION STUDIES, Institute of Hydrology, Wallingford (England).

D. Newson.

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 118-124, March 1972. 1 fig, 32 ref.

Descriptors: \*Karst hydrology, \*Hydrogeology, \*Data collections, Water quality, Water balance, Streamflow, Sampling, Stream gages, Karst, Geomorphology, Tracers, Erosion, Weathering.

Hydrological techniques and methods can be of value in karst erosion studies. Water tracing allows quantification of network properties and, in con-junction with flow measurement, separation of major components of outflow. The behavior of chemical and mechanical erosion can be related to flows, often by the use of cheap and temporary in-strumentation. Analysis of longer records allows construction of flow duration and flood frequency curves, enabling temporal predictions of erosion rates to be made. The water balance has relevance rates to be made. The water catance has relevance for karst erosion estimates. Hydrological work in fissured limestones has value in the field of water supply, pollution, and subsurface engineering. Comprehensive hydrological data collection in karst areas may eventually lead to compound mathematical expressions for karst development via a series of interim simple models. (Knapp-W72-09868

THE BLUE WATERHOLES, COOLEMAN PLAIN, N.S.W., AND THE PROBLEM OF KARST DENUDATION RATE DETERMINA-

TION, Australian National Univ., Canberra. J. N. Jennings. Australian National Univ., Canberra.

Descriptors: \*Karst hydrology, \*Erosion, \*Weathering, \*Australia, Water chemistry, Karst, Groundwater movement, Geochemistry, Car-bonate rocks, Limestones. Identifiers: Cooleman Plain (Australia).

Erosion was studied in Cooleman Plain, an upland, grassland, karstic plain in Australia. The plain truncates Silurian limestone in a structural basin. It is surrounded by forested ranges of igneous rocks of acid to intermediate composition. Total hardness had the usual inverse relationship with discharge. Summer, and autum evaporation discharge. Summer and autumn evaporation causes concentration of salts in surface waters. causes concentration of salts in surface waters. High discharges involve more rapid transit of water through cave systems, reducing time of contact during which solution may take place. At these times surface flow dilutes groundwater at the Blue Waterholes. There is a significant difference between the mean surface flow hardness (57 mg/l) and that of the groundwater (86 mg/l). (Knapp. LISGS) (Knapp-USGS) W72-09869

California Univ., Riverside. Dept. of Soils and Plant Nutrition

For primary bibliographic entry see Field 04D.

ERODIBILITY OF NEW ZEALAND SOILS, New Zealand Agricultrual Engineering Inst., Can-

terbury.
T. B. Khatri Chhetri, and D. J. Painter. Journal of Hydrology (New Zealand), Vol 10, No 1, p 49-58, 1971. 2 fig, 16 ref.

Descriptors: "Soil erosion, "Laboratory tests, "Simulated rainfall, Overland flow, Erosion, Runoff, Rill erosion, Sheet erosion, Soil conservation, Sediment yield, Soil properties, Surface ru-Identifiers: \*New Zealand.

The effects of soil erodibility on potential land use and sediment yield production in New Zealand is discussed. Erodibility must be considered for land use planning in the context of a particular erosion type. Methods are given for direct laboratory and field measurement of erodibility in the context of rainfall and overland flow erosion by direct measurement of soil loss from field plots under natural or simulated rainfall. Field methods are used to provide values of erodibility for use with the universal soil loss equation. Soil loss may be measured directly under simulated rainfall from samples of soil which range in size from a few hundred cubic centimeters to a few cubic meters. Where combinations of soil properties are indicators of erodibility, they are used to estimate the erodibility of other soils for which no direct measurements have been made. The simulated rainfall used in laboratory studies has a continuous spectrum of laboratory studies has a continuous spectrum of drop sizes, larger than corresponding natural rain-fall, but of lower terminal velocity, so that the kinetic energy is comparable. Rilling patterns form on the soil surface soon after runoff begins, and on the soil surface soon after runoff begins, and the pattern of erosion is similar to sheet and rill erosion on sloping, fallow fields. No one property or combination of a few properties could be used as a universal indicator of erodibility. (Knapp-USGS) W72-09877

EFFECT OF RUNOFF ON CORROSION INTENSITY IN THE NORTHWESTERN DINARIC KARST, I. Gams

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 78-83, March 1972. 5 fig, 10

Descriptors: \*Karst, \*Karst hydrology, \*Erosion, \*Water chemistry, Carbon dioxide, Hardness (Water), Runoff, Percolation, Discharge (Water), Springs. Identifiers: Yugoslavia.

The effect of runoff on corrosion in the northwestern Dinaric Karst, Yugoslavia was stu-died by the comparison of runoff coefficients, mean total hardness, corrosion intensities, annual precipitation, discharge, and total hardness of 23 rivers and 20 karst springs. Due to high precipita-tion and prevailing mountainous karst relief, the tion and prevaining mountainous karst renet, the runoff coefficient is high. In the alpine region, more runoff causes lowered total hardness. At ru-noff lower than 25-40 I/sec/sq. km., this relation is not as evident. At the same runoff the basins in Histria, where lowland plateau-like karst with islands of flysch prevail, have the highest total hardness. Precipitation in the months from Janua-ry to May causes a slight decrease of the hardness, ry to May causes a signt decrease of the hardness, yet from June to December, especially in Autumn, there is a considerable increase of the total hardness. Much more precipitation is needed in the second half of the year to reduce the total hardness than in the first half of the year. This can be explained by more storage of the soil CO2 at the end of the growing season and in the early winter time. (Knapp-USGS) W72-09883

EVIDENCE OF EARLY STAGES IN THE EVOLUTION OF THE DERBYSHIRE KARST, Leicester Univ. (England). Dept. of Geology.

#### Group 2J-Erosion and Sedimentation

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 73-77, March 1972. 2 fig, 12

Descriptors: "Karst, "Karst hydrology, "Erosion, Hydrogeology, Glacial drift, Limestones, Car-bonate rocks, Geomorphology, Sedimentation. Identifiers: Derbyshire (England).

Mio-Pliocene sediments perserved as the fill of solution collapse pockets on the Carboniferous Limestone plateau of Derbyshire, England, formerly lay horizontally on a thin layer of Upper Carboniferous Shales and on chert gravel forming the residue of solutional weathering of the upper most beds of the limestone. The horizontal capping of Pleistocene till demonstrates that considerable solution took place under a cover of some 53 m of sediments during Pliocene times, producing the fossil karst now seen. (Knapp-USGS) W72-09884

THE LIMESTONE BUGABOO: SURFACE LOWERING OR DENUDATION OR AMOUNT OF SOLUTION.

Oxford Univ. (England). School of Geography. R. P. Beckinsale.

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 55-58, March 1972. 30 ref.

Descriptors: \*Erosion, \*Limestones, hydrology, Hydrogeology, Percolation, Carbonate rocks, Geomorphology, Karst, Weathering, Solu-bility, Leaching, Groundwater movement, Water chemistry.

If denudation of limestone operates to any extent at depths of much more than 1 m, all rates and relative denudation must be related to volume of rock involved rather than to surface areas of outcrops. The volume of limestone involved must be measured in depth from the outcrop or intake to the point of issue of the drainage or point of measurement of its mineral content. The volumetric approach, if applied also to impervious strata, will lead to clarification and correction of the rates of differential denudation, and demonstrates that denudation and surface lowering are not synonymous in large areas of the world. (Knapp-USGS) W72-09886

SOME NOTES ON CHALK EROSION IN DENMARK

Geografisk Institut, Aarhus (Denmark).

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 52-53, March 1972. 4 ref.

Descriptors: \*Erosion, \*Limestones, Karst hydrology, Solution, Groundwater, Glacial drift, Topography, Geomorphology, Carbonate rocks, Solubility. Identifiers: Denmark, Sea-cliff erosion, Chalk.

The chalk beds in Denmark are largely covered by Quaternary deposits. The consequent practical problems for geomorphological, hydrological and chemical work are discussed. Particular reference is made to collapse hollows in the chalk and the overburden and a sea cliff in chalk and moraine Although most Danish water supplies are drawn from groundwater, the complexity of the Quaternary cover has so far not permitted a clear un-derstanding of the flow patterns and divides. In a sea cliff on the north coast of Jutland, about half of the 40 m height is chalk, while the rest is in moraine and some outwash materials. The recession rate was measured at various elevations and in various lithologies. At the foot of the cliff, up to about 1-2 m above the beach, surface abrasion and solution are dominant. Above this level, up to 5-7 m, rock is removed in discrete pieces, 0.5 to 3 cm thick. At higher levels rock removal is more sporadic, and major collapse dominant. In these two zones the rate of recession exceeds 3 cm per year. (Knapp-USGS)

W72-09887

GROINS: AN ANNOTATED BIBLIOGRAPHY. Army Coastal Engineering Research Center, Washington, D.C. J. H. Balsillie, and R. O. Bruno.

Miscellaneous Paper No. 1-72, April 1972. 249 p.,

Descriptors: \*Groins (Structures), \*Shore protection, \*Breakwaters, Bibliographies, Materials, Economics, Gabions, Coastal engineering, Beach erosion. Sand waves. Identifiers: \*Littoral processes.

A groin is a shore protective structure built (usually perpendicular to the shore) to trap sedi-mentary material or to retard erosion of the shore. Of all the shore protective structures used by coastal engineers, the groin is the most difficult to design - functionally and structurally. Because this design - functionally and structurally. Because this complexity of design was not recognized until recently, many early groin installations were failures. CERC supports a continuing research program devoted to gaining a better understanding of groins. This bibliography evolved from the groin research program. About 460 articles published since 1900 on groins and groin-type structures are presented in this bibliography. Annotations accompany each bibliography: entry where possible Indexes of authors, titles, and subwhere possible. Indexes of authors, titles, and sub-jects are included to aid the researcher. Unavailabel iterature such as foreign articles, although not annotated, are included as entries in both the an-notated section and the indexes. (CERC) W72-10056

SUSPENDED MATTER IN MONTEREY BAY, CALIFORNIA: SOME ASPECTS OF ITS DISTRIBUTION AND MINERALOGY,

Naval Postgraduate School, Monterey, Calif.

M. Kazanowska.

Available from the National Technical Informa-tion Service as AD-734 869, \$3.00 in paper copy, \$0.95 in microfiche. M Sc Thesis, September 1971. 78 p, 39 fig, 2 tab, 11 ref, append.

Descriptors: \*Suspended load, \*Particle size, \*Distribution, \*Mineralogy, X-ray analysis, \*Distribution, \*Mineralogy, X-ray analysis, Depth, Rivers, Runoff. Identifiers: \*Monterey Bay (Calif), Light scattering. Scattering ratios.

Suspended particulate matter distribution in Monterey Bay, California, was characterized by the ratio of light scattering at 45 deg to that at 135 deg, by particle volume distributions, and constituent distributions. Distributions varied with time and location. High scattering ratios and high volume distributions were found in the same vicinity but there appeared to be a lack of correlation between there appeared to be a lack of correlation between their absolute values. Depth had a definite in-fluence on scattering ratios. The minerals, deconsidering ratios. The minerals, detected by x-ray methods, in the water column at the Pajaro and the Salmias River mouths did not form separate and distinct regions. Jadeite was found to predominate in the Pajaro River area. (Ensign-PAI) W72-10148

THE USE OF GRASSES FOR DUNE STA-BILIZATION ALONG THE GULF COAST WITH INITIAL EMPHASIS ON THE TEXAS COAST, Gulf Universities Research Corp., Lubbock, Tex.; and Texas Tech Univ., Lubbock. D. W. Woodard, B. E. Dahl, R. L. Baker, and D.

W. Feray.
Available from the National Technical Informa-tion Service as AD-733 938, \$3.00 in paper copy, \$0.95 in microfiche. Final Report for 1969-1970, September 1970. 70 p. 24 fig, 8 tab, 57 ref, append. DACW 72-69-C-0012-X-02.

Descriptors: \*Gulf of Mexico, \*Texas, \*Dunes, \*Reclamation, \*Erosion, \*Grasses, \*Oats, Tides, Storm surge, Waves, Burning. Identifiers: \*Padre Island, \*Bitter panicum, Shoredune panicum, Sea oats.

The 1,622 mile coastline of the Gulf of Mexico va-ries from mainland sand beaches to marine marshes and offshore barrier islands. These barrier islands afford natural protection from tides, storm surges and hurricane generated waves. Dur-ing violent storms wave heights will vary from 1 30 feet, depending on depth of water and storm in-tensity. Significant erosion does take place in the low areas due to the effects of overgrazing, man's destruction, fire and storm surges which have stripped large areas. Padre Island, Texas, is the site of a study to establish specifications for rebuilding and revegetation of the primary dures. Different species of grasses which have the necessary attributes for beach plantings such as ability to grow in the salt spray zone, to trap sand, and to continue growth during sand accumulation are discussed and results are presented. (Ensign-PAI) W72-10151

A FREEZING CORE METHOD FOR DESCRIB-ING THE VERTICAL DISTRIBUTION OF SEDI-MENTS IN A STREAMBED, Waterloo Univ. (Ontario). Dept. of Biology.

For primary bibliographic entry see Field 07B.

A PARTIAL GEOCHEMICAL STUDY OF SHAL-LOW MARINE SEDIMENTS, CARDIGAN BAY (WALES), University Coll. of North Wales, Bangor.

For primary bibliographic entry see Field 02K.

POLLEN AND PALEOSALINITY ANALYSES FROM A HOLOCENE TIDAL MARSH SEQUENCE, CAPE MAY COUNTY, NEW JER-

Newark State Coll., Union, N.J. A. L. Meyerson. Marine Geology, Vol 12, No 5, p 335-357, May 1972. 7 fig, 29 ref.

Descriptors: \*Paleoclimatology, \*Palynology, \*Cores, \*Wetlands, \*New Jersey, Salinity, Tidal marshes, Coastal marshes, Salt marshes, Stratigraphy, Quaternary period, Paleohydrology, Water level fluctuations, Sea level.

Identifiers: \*Paleosalinity.

Evaluation of sediment types, SPM paleosalinity values, and pollen spectra for the Dennis Creek Tidal Marsh, New Jersey, indicates fluctuation of marsh environments related to rate of sea-level rise. The rise of sea level which initiated and accompanied the deposition was not constant, but changed throughout the period of time represented by the Dennis Creek sequence. Prior to about 3000 years ago, an open water environment existed, fol-lowed by the development of a Spartina alter-niflora marsh. A decrease in the rate of sea-level rise allowed a fresh-water environment to move out over the established marsh. A later increase in the rate of sea-level rise produced a marine transthe rate of sea-lever use produced a manne damagerssion again establishing the marsh area. Areas immediately adjacent to major tributaries responded to the transgressions to a greater degree than those areas further away. The evidence of man's colonization of the area is quite clear in the collection of the area is quite clear in the collection of the area is quite clear in the collection of the area is quite clear in the collection of the area is quite clear in the collection of the area is quite clear in the collection. pollen record. (Knapp-USGS) 72-10247

AN ANALYSIS OF THE MINERAL DISTRIBUTION PATTERNS IN THE RECENT SHELF SEDIMENTS OFF MANGALORE, INDIA, Geological Survey of India, Calcutta. Marine

Geology Unit. H. N. Siddiquie, and T. K. Mallik. Marine Geology, Vol 12, No 5, p 359-391, May 1972. 10 fig, 2 tab, 13 ref.

Descriptors: \*Bottom sediments, \*Mineralogy, \*Provenance, \*Continental shelf, Distribution patterns, Sedimentation, Particle size, Sediment transport. Identifiers: Mangalore (India).

# Chemical Processes—Group 2K

Mineralogical studies of the 0.062-0.125 mm and 0.125-0.25 mm fractions of samples collected at a spacing of 1-2 km on the inner shelf of Mangalore, India, were made to analyze the various factors controlling distribution patterns. The light fraction consists predominantly of quartz with minor orthoclase, plagioclase, muscovite and rock fragments. The heavy minerals consist of hornblende, muscovite, tremolite-actinolite, garnet, sillimanite, kyanite, orthopyroxene, augite-diopside, epidote, zircon, monazite, tourmaline, rutile and opaques. The assemblage defines three distinct mineralogical provinces and suggests derivation from a mixed metamorphic and igneous terrain with a predominant contribution from metamorphic rocks. On the basis of the enlargement or shifting of the area of concentration of the heavy minerals in the fine fraction compared to the coarse fraction, the predominant direction of dispersal of sediments is inferred to be southwest and west. (Knapp-USGS)

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COMPARISON OF A GRAB SAMPLER AND LARGE VOLUME CORER, Georgia Univ., Sapelo Island. Marine Inst. For primary bibliographic entry see Field 07B. W72-10249

PRODUCTION OF CALCIUM CARBONATE ON THE MAINLAND SHELF OF SOUTHERN CALIFORNIA, Hawaii Univ., Honolulu. Dept. of Oceanography.

Limnology and Oceanography, Vol 17, No 1, p 28-41, January 1972. 2 fig, 9 tab, 49 ref. ONR NR 083

Descriptors: \*Calcium carbonate, \*Continental shelf, \*California, \*Productivity, Sedimentation, Benthos, Sediment transport, Carbonates, Bottom

Although calcareous organisms are abundant on hard-bottom portions of the southern California mainland shelf, negligible amounts of Ca CO3 are accumulating there. Subtidal rates of CaCO3 production by calcareous organisms were calculated to be near 400 g CaCO3 per square m per year, from turnover rates, growth rate, mortality, distribution and from miscellaneous information. year, from turnover rates, growth rate, mortality, distribution, and from miscellaneous information. Although this temperate climate production rate is lower than rates of coral reef production, it is similar to tropical nonreef production rates and much higher than pelagic production rates of CaCO3. The CaCO3 produced is lost from the mainland shelf, probably by transportation to adjacent basins, and then is apparently in large part dissolved. (Knapp-USGS) W72-10250

SUSPENDED MATTER IN SURFACE WATERS OF THE NORTHERN GULF OF MEXICO, Geological Survey, Woods Hole, Mass.; and Woods Hole Oceanographic Institution, Mass. F. T. Manheim, J. C. Hathaway, and E. Uchupi. Limnology and Oceanography, Vol 17, No 1, p 17-27, January 1972. 6 fig, 44 ref.

Descriptors: \*Suspended load, \*Sea water, \*Gulf of Mexico, \*Turbidity, Seston, Plankton, Suspended solids, Mineralogy, Suspension, Deposition (Sediments), Sedimentation.

Suspended matter in concentrations greater than 1 mg/liter was restricted to within a few kilometers off Florida, but extended more than 100 km off Louisiana and Texas in late fall, 1966. Suspensates from areas farther than 100 km from shore contained mainly combustible organic matter, part of which was attributable to living plankton. Organic which was attributable to fiving plankton. Organic aggregates encompassing appreciable amounts of inorganic detritus were particularly noteworthy in transitional areas. Zooplankton metabolism and fecal pellet production appears to be a geologically significant mechanism for depositing fine suspended matter and may contribute to the zona-

tion of bottom sediments. The mineral composition of surface suspensates changes from a low magnesian calcite-aragonite suite off Florida to montmorillonite-kaolinite combinations from Alabama to Texas. The mineral composition of the suspensates resembles that of the bottom sedi-ments in each area. (Knapp-USGS) W72-10251

ON THE VARIATION IN DIRECTION OF THE HORIZONTAL COMPONENT OF REMANENT MAGNETISATION IN LAKE SEDIMENTS, Freshwater Biological Association, Ambleside F. J. H. Mackereth.

Earth and Planetary Science Letters, Vol 12, No 3, p 332-338, November 1971. 4 fig, 9 ref.

Descriptors: \*Bottom sediments, \*Paleolimnology, \*Magnetic studies, \*Dating, Sedimentation, Lakes, Mud, Mineralogy, Stratigraphy, Sampling, Identifiers: \*Remanent magnetism, England.

Variation in direction of the horizontal component of remanent magnetization with depth was mea-sured in the sediments of the South basin of Winsured in the sediments of the South basin of Win-dermere, England. Six m long cores from the sedi-ment span a time interval extending from the present to late-glacial times. The direction of the horizontal component of magnetization oscillates about the mean direction with an amplitude of about plus or minus 20 deg and frequency 2700 yr. A time scale assigned to the sedimentary sequence on the assumption of constant frequency for this oscillation is in good agreement with C-14 dating of the sequence. The sediments of freshwater lakes contain an accurate record of the directional variations of the horizontal component of Earth's magnetic field during the period of sedimentation and these variations can provide a time scale in such materials. (Knapp-USGS) W72-10253

THE SURFACE CHARGE OF PARTICULATE MATTER IN SEAWATER, Naval Research Lab., Washington, D.C. For primary bibliographic entry see Field 02K. W72-10257

FACTOR ANALYSIS OF DRAINAGE BASIN PROPERTIES: EVIDENCE FOR STREAM AB-STRACTION ACCOMPANYING T DEGRADATION OF RELIEF, Alberta Univ., Edmonton. Dept. of Geography.

A. D. Abrahams. Water Resources Research, Vol 8, No 3, p 624-633, June 1972. 4 fig, 3 tab, 23 ref.

Descriptors: \*Geomorphology, \*Erosion, \*Terrain analysis, \*Drainage patterns (Geologic), \*Correla-tion analysis, Regression analysis, Statistical methods, Topography, Canyons, Valleys, Identifiers: \*Australia, \*Factor analysis.

In third order basins in five landscapes in eastern Australia, basin area, stream length, basin relief, basin perimeter, and stream number were studied using factor analysis. Departures from topological randomness are associated with the evolutionary decline of relief. Regressions between the geometric mean bifurcation ratio and relief indicate that very small headwater streams have been ab-stracted from the drainage networks in the two landscapes where relief has been erosionally reduced below 200 ft. (Knapp-USGS) W72-10280

CONTENTS OF TOTAL AND MOBILE TRACE ELEMENTS IN ERODED SOILS OF THE LU-GANSK REGION, (IN RUSSIAN), For primary bibliographic entry see Field 02G. W72-10309

WATER EROSION OF SOIL3 IN THE SARATOV REGION, (IN RUSSIAN), S. V. Noumov. Privolzhskoe kn. izd.: Saratov. 1970. 127p. Illus. Identifiers: "Erosion control, Saratov, Soils, \*\*ILSOP\*\*

The distribution, characteristics and intensity of erosion processes are described. The forms of erosion formations are classified by kinds of soil removal and lineal erosion intensity. The theory of water erosion is discussed, and the main erosion control measures for individual districts in the region are delinated .-- Copyright 1972, Biological Ab-W72-10312

VARIABILITY OF RIVER PATTERNS, Colorado State Univ., Fort Collins. Dept. of Geology; and Colorado State Univ., Fort Collins. Engineering Research Center. S. A. Schumm, H. R. Khan, B. R. Winkley, and L. G. Robbins. Nature Physical Science, Vol 237, No 74, p 75-76, May 29, 1972. 2 fig, 5 ref.

Descriptors: \*Meanders, \*Channel morphology, \*Model studies, Mississippi River, Sediment transport, Bed load, Slopes, Alluvial channels, Braiding, Geomorphology, Sediment load.

Model studies of the dependence of river patterns on sediment load and on the inclination of the sur-face on which the model river flows—the valley slope—show that at a constant discharge very dif-ferent channel patterns are formed at different slopes. In these experiments, sediment was fed into the model channels at a rate calculated to prevent either aggradation or degradation. The sinuosity of the Mississippi River varies with valley slope in the manner predicted. The lowest sinuosity evidently occurs on the gentlest valley slopes which are characteristic of the lower 200 slopes which are characteristic of the lower 200 miles of river. Variations of valley slope can be caused by slight uplift, depression or tilting of the valley, or by a great difference in the sediment loads carried by tributaries and the principal channel. For example, below the junction of the Arkansas River with the Mississippi, the valley slope increases significantly because of the relatively high sediment discharges from the Arkansas River during the Pleistocene. (Knapp-USGS) W72-10348

PREDICTING DISTURBANCES TO THE NEAR AND OFFSHORE SEDIMENTARY REGIME FROM MARINE MINING, National Oceanic and Atmospheric Agency, Tiburon, Calif. Marine Minerals Technology Center. For primary bibliographic entry see Field 05B. W72-10352

#### 2K. Chemical Processes

IN SITU FLUOROMETER USING A SYNCHRONOUS DETECTOR, Prototypes, Inc., Kensington, Md.; and Zone Research, Inc., Washington, D. C. For primary bibliographic entry see Field 05A.

QUANTIFICATION OF LIMESTONE EROSION IN INTERTIDAL, SUBABRIAL AND SUBSOIL ENVIRONMENTS, WITH SPECIAL REFERENCE TO ALDABRA ATOLL, INDIAN OCEAN, Bristol Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 02J. W72-09860

SOLUTION INTENSITY ON VARIOUS TYPES
OF CALCAREOUS ROCKS IN
CZECHOSLOVAKIA,
Ceskoslovenska Akademie Ved, Brno. Ceskoslovenska Geograficky Ustav.

# **Group 2K—Chemical Processes**

O. Stelcl.

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 174-175, March 1972. 1 tab.

Descriptors: \*Solubility, \*Carbonate rocks, \*Karst, \*Weathering, Karst hydrology, Water chemistry, Limestones, Dolomite, Erosion, Lacching. Leaching. Identifiers: Czechoslovakia.

Research on the intensity of karst processes in Czechoslovakia has been carried out since 1958. The main conditions affecting the intensity of karstification, such as the extent and thickness of carbonates, the morphological character of the re-lief, the climatic conditions, the character of karst hydrography, and the biological cover were osen to be comparable, and the petrographical character of carbonates was different. Regions were chosen where the rocks are very pure sedimentary limestones, dolomitic limestones, mentary limestones, dolomitic limestones, dolomites and marbles. A sequence of calcareous rocks is listed according to their solubility in the conditions of the Central European climate in Czechoslovakia. The base of this scale is expressed by the index 1, which is the value of the least soluble marbles. When the marbles are characterized by the index 1, the indices of other calcareous rocks are: carbonates, 6.6; dolomitic carbonates, 3.1; and dolomites, 2.3. (Knapp-USGS) W72-09861

HYPOTHESES OF KARST LANDFORM DEVELOPMENT IN JAMAICA. Bristol Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 02J. W72-09862

METHODS OF ISOLATING AND QUANTIFY-ING SOLUTION FACTORS IN THE LABORA-TORY, Goettingen Univ. (West Germany). Geogra-

phisches Institut. K. Priesnitz.

Cave Research Group of Great Britain Transac-tions, Vol 14, No 2, p 153-158, March 1972. 2 fig, 5

Descriptors: \*Water chemistry, \*Laboratory tests, \*Limestones, \*Karst hydrology, \*Kinetics, Saturation, Calcite, Solubility, Gypsum.

Solubility (maximum concentration), solution velocity, and their consequences on limestone solution are discussed. For example, with anhydrite and gypsum, higher solubility does not necessarily mean higher solution velocity. Geomorphologists should mainly be interested in isolating the influence of single factors on solution velocity. This only is possible in an open system and the easiest way to keep other factors constant is by using large surpluses of solvent and gas in the required concentrations in experiments. A modified Soxhlet extraction apparatus is proposed as a useful device for this differential analysis. (Knapp-USGS) W72-09863

THE CONTRAST BETWEEN DERRYSHIRE AND YORKSHIRE IN THE AVERAGE VALUE OF CALCIUM CARBONATE IN THEIR CAVE AND KARST WATERS, Hull Univ. (England). Dept. of Geography. For primary bibliographic entry see Field 02F. W72-09864

THE PH OF CALCITE SOLUTIONS WITH AND WITHOUT MAGNESIUM CARBONATE PRESENT, AND THE IMPLICATIONS CONCERNING REJUVENATED AGGRESSIVENESS, R. G. Picknett.

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 141-150, March 1972. 7 fig, 3

Descriptors: \*Karst hydrology, \*Weathering, \*Limestones, \*Dolomite, \*Water chemistry, Calcium carbonate, Magnesium, Leaching, Calcite, Erosion, \*Hydrogen ion concentration, Mineralo-Identifiers: Aggressiveness (Water).

The pH values of saturated calcite solutions were measured over a wide range of temperature and composition. The results differ markedly from cal-culated values published for aggressiveness estimations. Further experiments, at 10 deg C only, show that traces of magnesium carbonate in the saturated calcite solution have a marked effect on the pH. It is suggested that the 'marble' method of aggressiveness estimation should be used in preference to pH methods. Considerable rejuvenation of aggressiveness towards limestone should result from the mixing of waters of differing magresult from the mixing of waters of untering mag-nesium content, the phenomenon being comple-mentary to Bogli's 'mixed-water corrosion' theory. (Knapp-USGS) W72-09865

RESPONSES IN THE CHEMISTRY OF SPRING WATERS IN THE OXFORD REGION TO SOME CLIMATIC VARIABLES, Christ's Coll., Liverpool (England). For primary bibliographic entry see Field 02F.

PROBLEMS OF THE DISSOLUTION OF DOLOMITIC ROCKS (PROBLEMES DE LA DISSOLUTION DES ROCHES DOLOMITIQUES),
Aix-Marseille Univ. (France). Institut de Geogra-

phie. For primary bibliographic entry see Field 02J.

MERITS OF A HYDROLOGICAL BIAS TO KARST EROSION STUDIES, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 02J. W72-09868

THE BLUE WATERHOLES, COOLEMAN PLAIN, N.S.W., AND THE PROBLEM OF KARST DENUDATION RATE DETERMINA-

Australian National Univ., Canberra. For primary bibliographic entry see Field 02J.

AN ACCURATE METHOD FOR CALCULAT-ING SATURATION LEVELS OF GROUND WATERS WITH RESPECT TO CALCITE AND Pennsylvania State Univ., University Park. Dept.

of Geosciences.

R. L. Jacobson, and D. Langmuir. Cave Research Group of Great Britain Transac-tions, Vol 14, No 2, p 104-108, March 1972. 2 fig, 4

Descriptors: \*Aqueous solutions, \*Water chemistry, \*Calcium carbonate, \*Chemical potential, \*Geochemistry, Hydrogen ion concentration, Groundwater, Equilibrium, Calcite, Dolomite.

A procedure is outlined for the calculation of saturation indices for carbonate waters with respect to calcite and dolomite and for calculating an equilibrium carbon dioxide pressure. The Trombe nomographs are seriously in error both because of outdated equilibrium constants and because of oversimplification of the water chemistry. Even corrected Trombe-type nonographs are not sufficiently accurate to evaluate the degree of saturation of waters. The use of computed saturated in-dices is recommended. The main source of errors is in the measurement of pH and the tendancy for de-gassing of CO2 from the groundwater samples after collection. (Knapp-USGS)

CHEMISTRY OF CARBONATE DENUDATION IN NORTH AMERICA, McMaster Univ., Hamilton (Ontario). Dept. of Geology. For primary bibliographic entry see Field 02F.

LABORATORY SIMULATION OF LIMESTONE SOLUTION. University Coll. of Swansea (Wales). Dept of Geography. G. E. Groom, and D. P. Ede.

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 89-95, March 1972. 2 fig, 2 tab, 5 ref.

Descriptors: \*Leaching, \*Limestones, \*Water chemistry, Soil chemistry, Soil-water-plant rela-tionships, Karst, Karst hydrology, Weathering, Carbonate rocks, Laboratory tests, On-site tests.

Limestone solution was tested in static and running-water conditions. Under normal at-mospheric pressures the concentrations of CaCO3 taken up by different types of water do not approach the concentrations found in natural river and spring waters. Rainwater percolating through columns of vegetated soil dissolved concentrations of CaCO3 varying between 3-333 ppm, according to the soil type. A column of soil with grass vegetation on top of a column of limestone chippings showed an increase of CaCO3 in water passing through it of 326 pp, which was considerably larger than the 39 ppm increase of CaCO3 in the water passing through a control column of the soil alone. The soil may, therefore, be considered as a zone which both provides a source of CaCO3 and also enhances the solutional potential of percolating waters. (Knapp-USGS)

EFFECT OF RUNOFF ON CORROSION INTEN-SITY IN THE NORTHWESTERN DINARIC For primary bibliographic entry see Field 02J. W72-09883

PRELIMINARY OXIDATION STUDIES ON SOME CAVE WATERS FROM SOUTH WALES. L. G. Bray.

Cave Research Group of Great Britain Transactions, Vol 14, No 2, p 59-66, March 1972. 1 fig, 3 tab, 16 ref.

Descriptors: \*Weathering, \*Leaching, \*Water chemistry, \*Karst hydrology, \*Oxidation, Organic matter, Hydrogen ion concentration, Groundwate movement, Karst, Limestones, Carbonate rocks.

The chemistry of limestone erosion was studied in South Wales cave systems. Total hardness of water is estimated by EDTA titration using methylthymol blue indicator, and oxidizable organic matter is estimated by the 4-hour permanganate value test. Results are quoted from 19 samples of water from 13 different sites. A correlation is established between the limestone-attacking power (aggressiveness) of a water and its perman ganate value, showing the importance of organic matter in limestone erosion. The speed of reactions taking place in caves and the effect of flooding on the chemistry of cave water are discussed. A hypothetical mechanism for limestone attack by organic matter is advanced. (Knapp-USGS) organic ma W72-09885

DETERMINATION OF DISSOLVED OXYGEN AND NITROGEN IN WATER USING GAS CHROMATOGRAPHY, (IN GERMAN), Schweizerische Unfallwersicherungsanstalt, Lucerne. Abteiling Unfallverhuetung.
For primary bibliographic entry see Field 05A.

# Chemical Processes—Group 2K

A CONVENIENT METHOD OF ANALYSIS OF HUMIC ACID IN FRESH WATER, University of South Florida, Tampa. Dept. of Chemistry; and University of South Florida, St. Petersburg. Marine Science Inst. For primary bibliographic entry see Field 05A. W72-10201

STUDIES ON THE WATER CHEMISTRY AND BOTTOM FAUNA OF BRASHEARS CREEK, SPENCER AND SHELBY COUNTIES, KEN-TUCKY, Louisville Univ., Ky. Dept. of Biology.

J. D. Woodling.

M Sc Thesis, University of Louisville Graduate
School, August 1971. 101 p, 10 fig, 11 tab, 33 ref,
append. OWRR B-005-KY (2) and B-016-KY (2).

Descriptors: \*Water chemistry, \*Nitrates, \*Phosphates, \*Biomass, \*Productivity, Benthos, Kentucky, Aquatic animals, Benthic fauna, Aquatic insects, Diptera, Water quality, Nutrients, Aquatic productivity.

Identifiers: Brashears Creek (Ky).

The water of Brashears Creek, in central Kentucky, a 41.9 km long stream, is characterized by high carbonate concentrations, from 132 mg/liter to 217 mg/liter. Nitrate levels are from 9.6 mg/liter to 0.5 mg/liter. Orthophosphate is more abundant than in most natural waters, from 0.28 mg/liter to 2.05 mg/liter. Nitrogen may be a limiting factor on productivity during part of the year. A rapidly fluctuating water level is caused by periods of heavy precipitation. Bottom fauna biomass and average numbers of organism are highest in the spring and lowest in the summer. Biomass values range from 1.38 g/sq ft in the spring to below 0.2 g in the summer. Average numbers range from a high of 448.5/sq ft to 3.3/sq ft. Diptera dominated in abundance during the spring and Ephemerop-tera in the fall. Productivity and diversity are always greater in riffle areas than pool areas. (K-napp-USGS) W72-10243

A PARTIAL GEOCHEMICAL STUDY OF SHAL-LOW MARINE SEDIMENTS, CARDIGAN BAY (WALES), University Coll. of North Wales, Bangor.

Marine Geology, Vol 12, No 5, p 313-333, May 1972. 10 fig, 2 tab, 29 ref.

Descriptors: \*Bottom sediments, \*Geochemistry, Postribution patterns, "Particle size, Iron, Phosphorus, Manganese, Titanium, Glacial drift, Provenance, Adsorption, Mineralogy. Identifiers: "Cardigan Bay (Wales).

The areal distribution of iron, manganese, and titanium in Cardigan Bay, Wales, shows a good correlation with the distribution of mean size. The charted distribution of phosphorus shows no obvi-ous relationship with the textural or petrographic data. The isolated areas of higher values are close data. The isolated areas of nigher values are close to the coast. The four significant hosts for the elements in these Cardigan Bay sediments are: the accessory mineral suite; lithic fragments; clay minerals either because of adsorption or because of incorporation into the crystal lattice; and coating on grain suifaces. The average content of or incorporation into the crystal fattice, and coatings on grain surfaces. The average content of iron, manganese, titanium and phosphorus is similar to that of the average sandstone. Man-ganese is not noticeably enriched in these marine sediments. Phosphorus is to be bound in apatites but there are minor, though important contributions from lithic fragments and iron coatings in the gravel and sands. Adsorption becomes important in the finer sediments. (Knapp-USGS) W72-10244

THE SURFACE CHARGE OF PARTICULATE MATTER IN SEAWATER, Naval Research Lab., Washington, D.C. R. A. Neihof, and G. I. Loeb.

Limnology and Oceanography, Vol 17, No 1, p 7-16, January 1972, 3 fig, 3 tab, 30 ref.

Descriptors: \*Water chemistry, \*Suspended load, \*Sea water, \*Adsorption, \*Trace elements, Chemical potential, Ion exchange, Ion transport, Electrophoresis, Seston, Estuaries.

The surface charge of particulate matter in seawater from estuarine and coastal sources was investigated by microelectrophoresis. Seston consisting mostly of bacteria, small algae, and detritus exhibited a considerable range of mobilities but all were negatively charged; the mean mobility and the range of mobilities increased when the salinity of the media was reduced. The surface charge of model particles of glass, anion exchange resin, bentonite, calcium carbonate, wax, and a polysaccharide were also studied after equilibration in both natural seawater (freed of natural particulates) and an artificial seawater containing only major ions. The range of mean mobilities for these particles in artificial seawater was large, but it converged to a much smaller value in real seawater. The surface adsorption of minor constituents from The surface charge of particulate matter in sea-The surface adsorption of minor constituents from seawater is the most likely cause of these changes. Both high and low molecular weight materials were responsible. The macromolecular component could be removed from limited amounts of sea-water by a column of porous glass. (Knapp-USGS) W72-10257

THE CONTROL OF SEAWATER PH BY ION

PAIRING,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of
Oceanography.
P.J. Wangersky.
Limnology and Oceanography, Vol 17, No 1, p 16, January 1972. 3 fig, 1 tab, 9 ref.

Descriptors: \*Hydrogen ion concentration, \*Sea water, \*Chemical reactions, \*Water chemistry,
\*Saline water systems, Aqueous solutions,
Equilibrium, Chemical potential, Polyelectrolytes, Carbon dioxide.
Identifiers: \*Ion pairing.

The pH of seawater is controlled by the whole set of ion-pairing equilibria, involving all of the major ions in seawater, rather than by the simple reaction series between water and carbon dioxide. The resistance to change of this system is greater than the buffer capacity of the CO2 system, and the speed of reaction is much faster than that of the silicate system proposed by Sillen. (Knapp-USGS) W72-10258

MEASURING CHLORIDE IN EFFLUENT FLOWING FROM A SOIL COLUMN, Florida Univ., Gainesville. Dept. of Soil Science. For primary bibliographic entry see Field 02G. W72-10269

DISTRIBUTION OF CD, CO, CU, FE, MN, NI, PB AND ZN IN DISSOLVED AND PARTICULATE SOLIDS FROM TWO STREAMS IN TEN-

Tennessee Univ., Knoxville. Dept. of Geology. R M Perhac

Journal of Hydrology, Vol 15, No 3, p 177-186, March 1972. 1 fig, 5 tab, 2 ref. OWRR A-023-

Descriptors: "Trace elements, "Dissolved solids, "Sediments, "Suspended load, "Tennessee, Colloids, Silts, Water chemistry, Cadmium, Cobalt, Copper, Iron, Manganese, Nickel, Lead, Zinc, Heavy metals, Particle size, Sampling, Water analysis, Spectrophotometry.

Identifiers: Atomic absorption spectrophotometry.

trophotometry.

In order to study metal distribution in streams, four water samples were taken from two streams in northeast Tennessee. One drains an area of exposed minor zinc mineralization. Three classes of

trace elements were extracted from the water: coarse particulates, colloidal particulates, and dissolved ions. Each particulate fraction was extracted by continuous flow ultracentrityation. The dissolved solids in the remaining effluent were The dissolved solids in the remaining effluent were recovered by evaporation. Of the total trace metal load, the dissolved fraction accounts for over 95%; colloids make up less than 1%. The three fractions were totally dissolved and analyzed for Cd, Co, Cu, Fe, Mn, Ni, Pb and Zn. Despite its low concentration, generally over 90% of each metal occurs in the dissolved state. Less than 10% occurs with the coarse narticulates less than 10% occurs with the coarse particulates, less than 1% as colloids. (Knapp-USGS)
W72-10271

CHEMISTRY AND OCCURRENCE OF CADMI-UM AND ZINC IN SURFACE WATER AND GROUNDWATER,

Geological Survey, Menlo Park, Calif. Water Resources Div. J. D. Hem.

Water Resources Research, Vol 8, No 3, p 661-679, June 1972. 11 fig. 3 tab, 41 ref.

Descriptors: \*Water chemistry, \*Zinc, \*Cadmium, Surface waters, Groundwater, Trace elements, Spectrophotometry, Water analysis, Path of pollu-tants, Water pollution sources, Carbonates, Solu-bility, Fallout.

The median concentration of zinc in 726 filtered samples of water taken from rivers and lakes of the United States in November 1971 was close to 20 micrograms per liter, and the median concentra-tion of cadmium was a little below 1 microgram per liter. The concentrations of both elements tended to be consistently higher in water from northeastern and southeastern states. Chemical thermodynamic calculations summarized by soluthermodynamic calculations summarized by solu-bility graphs suggest that the carbonale and hydroxide solubilities of these elements are higher than the concentrations commonly found, but for 24 of 80 analyses for which chemical equilibrium computations could be made, saturation with respect to one or both of the metals was closely approached. Zinc solubility may also be controlled by silicate in some waters. Biological factors and sorption by stream sediments may also be signifisorption by stream sediments may also be signifi-cant controls. Concentrations of cadmium above 10 micrograms per liter may be stable in water hav-ing low total solute concentrations and pH and can be difficult to remove by conventional water treat-ment processes. (Knapp-USGS) W72-10277

RADIANT ENERGY TRANSFER IN WATERS, Purdue Univ., Lafayette, Ind. School of Mechani-Cal Engineering.
R. Viskanta, and J. S. Toor.
Water Resources Research, Vol 8, No 3, p 595-608, June 1972. 14 fig, 1 tab, 24 ref.

Descriptors: \*Solar radiation, \*Energy budget, \*Heat transfer, Albedo, Heat budget, Heat flow, Temperature, Thermal pollution, Turbidity, Diffu-sion, Convection, Air-water interfaces. Identifiers: \*Radiant energy transfer.

A model is presented for predicting the local radi-ant flux and the net rate of gain or loss of radiant ant thus and the net rate of gam or loss of radiant energy per unit volume on spectral and total bases for a layer of natural water by using exact radiative transfer theory. The model considers attenuation (absorption and scattering) and multiple scattering by water and accounts not only for the transmission and internal reflection of radiation at the air-water interface but also for reflection at the the ar-water interface but also for reflection at the bottom. Some numerical results are reported for pure water, multiple scattering being neglected. The results show that analyses that neglect the spectral nature of the incident flux and assume water to be gray lead to appreciable errors in total radiant flux computations and in the amount of internal absorption of solar radiation. For accurate predictions, the reflection from the bottom and the internal reflection from the air-water interface ternal reflection from the air-water interface

#### **Group 2K—Chemical Processes**

must be properly accounted for in shallow waters. (Knapp-US W72-10282

#### 2L. Estuaries

characteristics.

CHEMICAL AND PHYSICAL CHARAC-TERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1968-SEPTEMBER 1969, Geological Survey, Austin, Tex.
D. C. Hahl, and K. W. Ratzlaff.
Texas Water Development Board Report 144,

April 1972. 161 p, 24 fig, 16 tab, 12 ref.

Descriptors: "Water quality, "Water analysis, "Water properties, "Estuaries, "Texas, Data collections, Sampling, Chemical analysis, Water chemistry, Water pollution sources, Path pollutants, Salinity, Nutrients, Insecticides, Herbicides, Water levels, Dissolved oxygen, Water temperature Provinces of Services, Parking, Parking perature, Environmental gradient.
Identifiers: Chemical characteristics, Physical

In September 1967, the U.S. Geological Survey, in cooperation with the Texas Water Development Board, began a water-resources investigation of the principal estuaries along the Texas coast except Galveston Bay and the Rio Grande. The objectives are to define: (1) the occurrence, source, and distribution of nutrients; (2) current patterns and directions and rates of movement; (3) physical, organic, and inorganic water quality and its areal distribution and time variation; (4) occur-rence, quality, quantity, and dispersion of drainage entering the estuarine systems; and (5) chemical and physical characteristics of water which enters the estuaries from the Gulf of Mexico. The data collected from October 1968 to Sep-

TEXTURAL VARIATION IN SUB-ENVIRO-NMENTS OF THE SHALLOW-WATER WAVE ZONE, KOUCHIBOUGUAC BAY, NEW BRUN-

tember 1969 are presented. (Woodard-USGS)

Toronto Univ. (Ontario). Dept. of Geography; and Scarborough Coll., Toronto (Ontario). Dept. of

Geography.
B. Greenwood, and R. G. D. Davidson-Arnott. Canadian Journal of Earth Sciences, Vol 9, No 6, p 679-688, June 1972. 3 fig, 4 tab, 40 ref. Grants G.S. 16-69 and N.R.C. A7956.

Descriptors: \*Bottom sediments, \*Waves (Water), \*Particle size, \*Distribution patterns, Statistics, Statistical methods, Regression analysis, Currents (Water), Sedimentary structures, Sediment transport, Canada, Beaches, Sand bars, Sand waves. Identifiers: \*Kouchibouguac Bay.

Textural analysis of sands from morphodynamic environments of a tidal, shallowwater, wave environment in Kouchibouguac Bay, New Brunswick, reveals sediment populations that are statistically unique to each zone under low wave energy conditions. Measures of average size, sorting, and skewness of sediment size distributions vary according to location in four sub-environments (offshore bar, trough, breaker zone, and swash zone). Phi kurtosis is environmentally sensitive in this area. Classification into environ-mental groupings is good. The relative importance of individual size-frequency statistics in the discrimination of adjacent environments is a result of the effects of changing morphology and wave-cur-rent conditions on the selective transport of sediments. (Knapp-USGS)

NATIONAL COASTAL ZONE MANAGEMENT ACT OF 1972. Congress, Washington, D.C.; and Committee on Commerce (U.S. Senate). For primary bibliographic entry see Field 06E.

FAUNAL AND ECOLOGICAL OBSERVATIONS ON THE ANIMAL POPULATIONS OF THE KARSTIC SWAMP PIETRA ROSSA (MONFAL-CONE): PART 2. (IN ITALIAN), Padua Univ. (Italy). Istituto di Biologia Anim. For primary bibliographic entry see Field 05C.

W72-09919

OBSERVATIONS ON THE PLANKTONIC LAR-VAE OF POLYDORA LIGNI WEBSTER (POLYCHAETA: SPINONIDAE), IN THE YORK RIVER, VIRGINIA,
Maryland Univ., College Park. Dept. of Zoology.

Chesapeake Sci. Vol 12 No 3 p 121-124. 1971. Illus. Identifiers: \*Larvae, \*Mudworm, Plankton, Polychaeta, Polydora ligni, River, Spionidae, Virginia, \*York River.

The occurrence of planktonic larvae of the polychaete P. ligni (mud worm) was followed for a period of 12 wk in 1970. Larvae first appeared on March 11 and weekly samples generally showed an increase in mean length throughout the sampling period. Larval length ranged from 0.19 mm to 1.15 mm. An initial settlement of metamorphosed larvae with a mean length of 1.25 mm occurred on test panels on April 14. The number of setigers was shown to vary directly with larval length. Larvae reared in the laboratory at 21 C required 19 to 28 days to develop fully, while larvae reared at 10 C required 60 to 69 days.--Copyright 1972, Biological Abstracts, Inc. W72-09932

A SCIENTIFIC SURVEY OF LAC ON BONAIRE AIMED AT THE PRESERVATION OF THIS LARGEST LAGOON IN THE NETHERLANDS ANTILLES, H. P. Wagenaar, and P. J. Roos.

Uitg Antuurwet Werkgroep Ned Antillen Curacao. Vol 18 p 1-28. 1969. Illus. Maps. (English summa-

dentifiers: Antilles, Lac on, Bonaire, Fauna, llora, \*Lagoons, Netherlands, Preservation, Scientific survey.

The physical and biological characteristics of the lagoon are described. Data on the flora and fauna of the area are evaluated and compared with earlier studies in connection with plans to develop the area. It is believed that proper management is needed to perserve the lagoon's scientific and aesthetic value .-- Copyright 1972, Biological Abstracts. Inc. W72-09934

THE COASTAL INTERFACE, Bureau of Commercial Fisheries Galveston, Tex. Biological Lab. For primary bibliographic entry see Field 04C. W72-10052

THE ESTUARY OF THE HUDSON RIVER, ILS.A. Natural Environment Research Council, London (England). For primary bibliographic entry see Field 05C. W72-10089

HYDROGRAPHY AND PLANKTON OF THE EIDER ESTUARY, (IN GERMAN), Bundesforschungsanstalt fuer Fischerei, Hamburg (West Germany). Institut fuer Kuesten- und Bin-

nenfischerie. H. Kehl, and H. Mann.

Veroff Inst Meeresforsch Bremerhave. Vol 13, No 1, p 163-181. 1971. Illus. Maps. English summary. Identifiers: Asterias rubens, Carcinus maenas, \*Eider estuary, Germany, \*Hydrography, Littorina littoria, Oikopleura doica, \*Plankton, Pleurobrachia pileus, Rathkea octopunctata, Sagitta

Water and plankton samples were collected from Water and plankton samples were collected from 1967-1970 at 10 stations in the Tide-Eider estuary between Nordfeld and Seegrenze. Alkalinity, pH, O2, nitrogenous compounds, turbidity and pollution were studied. Typical organisms include Rathkea octopunctata, Pleurobrachia pileus, Rathkea octopunctata, Pleurobrachia pileus, Sagitta setosa, Oilopleura doica, Carcinus maenas, Asterias rubens, and Littorina littorea.--Copyright 1972, Biological Abstracts, Inc. W72-10098

THE DEVELOPMENT OF FORECAST TECHNIQUES FOR WAVE AND SURF CONDITIONS OVER THE BARS IN THE COLUMBIA RIVER MOUTH AND AT THE ENTRANCE TO YAQUINA BAY.

Oregon State Univ., Corvallis. Dept. of Oceanography. W. H. Quinn, and D. B. Enfield.

Final Report to National Oceanic and Atmospheric Administration, Reference 71-9, May 1971. 29 p, 2 fig, 1 tab, 8 ref. NOAA E-225-69 (N).

Descriptors: \*Columbia River, \*Sand bars, \*Waves, \*Surf, \*Forecasting, Meteorology, Oceanography, Safety factors, Hazards. Identifiers: Yaquina Bay, Transit conditions.

The bar crossing problem at the Columbia River mouth and Yaquina Bay entrance is defined. The physical factors involved in hazardous transit developments and a method for predicting bar transit conditions enough in advance to allow for safety measures to be taken must be determined. Meteorological and oceanographic conditions leading to and during closures are being in-vestigated to find out their immediate causes and the nature of their temporal and spatial evolution. Recommendations to increase the effectiveness of marine safety and wave prediction are outlined. The nature and magnitude of the problem was determined, the background material has been compiled and analysis of the individual situations are now being performed. The goal of this continuing work is a prediction scheme which will apply to the various modes of development. (Ensign-PAI)

THE USE OF GRASSES FOR DUNE STA-BILIZATION ALONG THE GULF COAST WITH INITIAL EMPHASIS ON THE TEXAS COAST, Gulf Universities Research Corp., Lubbock, Tex.; and Texas Tech Univ., Lubbock.
For primary bibliographic entry see Field 02J. W72-10151

THE DDT PROFILE OF SOME SOUTH TEXAS COASTAL ZONE SEDIMENTS: A STUDY OF THE MECHANISMS OF POLLUTION DISPER-SAL AND ACCUMULATION IN NATURE, Texas A and M Univ., College Station. Dept. of Geology. For primary bibliographic entry see Field 05B. W72-10152

THERMAL CONDITIONS IN MONTEREY BAY DURING SEPTEMBER 1966 THROUGH SEP-TEMBER 1967 AND JANUARY 1970 THROUGH JUNE 1971,

Naval Postgraduate School, Monterey, Calif.

R. C. Anderson.

Available from the National Technical Information Service as AD-733 238, \$3.00 in paper copy, \$0.95 in microfiche. M Sc Thesis, September 1971. 78 p, 37 fig, 2 tab, 17 ref, 1 append.

Descriptors: \*California, \*Thermal water, \*Data collections, \*Isotherms, \*Temperature. Identifiers: \*Monterey Bay, Thermal conditions, Weekly data, Quasi-synoptic periods, Upwelling, Davidson current, Oceanic period.

Thermal studies were conducted in Monterey Bay from September 1966 to September 1967 and from January 1970 to June 1971. Comparisons of observations taken at approximately weekly intervals to the longtterm averages developed by Lammers (40 years) were made. Temperature data out to 80 miles in the Bay were taken in August 1970 and compared to observed thermal conditions during four quasi-synoptic periods in August. The norms provided an excellent basis to which direct temperature observations during quasi-synoptic periods could be compared. Comparisons of ther-mal indices (depth of 9 deg C isotherm, temperature at 20 meters, and sea surface temperature at various locations) proved valuable parameters in identifying the three climatic seasons of upwelling, oceanic and Davidson current as well as the existence of anomalous thermal conditions. (Ensign-W72-10153

FACTORS AFFECTING THE DISTRIBUTION OF FISHES IN WHITEWATER BAY, EVER-GLADES NATIONAL PARK, FLORIDA, Miami Univ., Fla.

Available from the National Technical Informa-tion Service as COM-71-01065, \$3.00 in paper copy, \$0.95 in microfiche. Sea Grant Technical Bulletin No 8, January 1971. 109 p, 10 fig, 9 tab, 80 ref, 3 append

Descriptors: \*Marine fish, \*Fish populations, \*Juvenile fish, \*Distribution patterns, \*Estuaries, Vegetation.

Identifiers: \*Whitewater Bay (Fla), \*Species distribution, \*Catch rates, Poisson distribution form, Fisher's logarithmic series.

Juvenile fish population studies were conducted in Whitewater Bay, Florida, from September 1968 to November 1969. Factors determining species distribution in the estuary and an assessment of the variations in catch rate were studied. A total of 68 variations in cater rate were studied. A total of so species representing 36 families and 14 orders were collected. The distribution of species per tow showed only partial agreement with the Poisson form of distribution. Total data for all species did not conform to Fisher's logarithmic series in all cases. Significant differences (P < or equal to .05) were observed for all fishes tested and could usually be attributed to differences in vegetation density. Differences in mean number of species captured among stations was also significant (P < or equal to .01) and probably resulted from vegetation and increased richness of fauna in high salinity areas. Freidman's two way analysis of variance for seasonal changes in catch rates were usually seemed to stem from population increases due to recruitment and later declines from seasonal migrations and mortality. (Ensign-PAI)

STUDIES OF THE USE OF VERTICAL SUB-STRATES FOR IMPROVING PRODUCTION OF PINK SHRIMP, PENAEUS DUORARUM BUR-KENROAD, Miami Univ., Fla.

For primary bibliographic entry see Field 08I. W72-10157

A STUDY OF THE FOOD OF JUVENILE MIGRATING PINK SHRIMP, PENAEUS DUORARUM BURKENROAD,

Miami Univ., Fla. S. Sastrakusumah.

Available from the National Technical Information Service as COM-71-01062, \$3.00 in paper copy, \$0.95 in microfiche. Sea Grant Technical Bulletin No 9, January 1971. 44 p, 1 fig, 4 tab, 24 ref.

Descriptors: \*Pink shrimp, \*Juvenile growth stage, \*Migration, \*Food habits, \*Foods, \*Diets, Density, Distribution, Reproduction, Growth Density, Distrates, Florida. Identifiers: \*Penaeus duorarum, Buttonwood Canal, Crustaceans, Polychaetes.

The food and feeding activities of the pink shrimp, Penaeus duorarum during its migration from estua-ry to offshore grounds were observed for one year in Florids. Stomach analyses takes for one rida. Stomach analyses taken from mo ebb tide samples in Buttonwood Canal showed low feeding activity in late winter and in summer. Highest feeding was in September. Preferred foods were crustaceans and polychaetes. Seagrasses, diatoms and foraminifera were not favored. Types of food chosen remained the same at different seasons of the year. No differences at different seasons of the year. No differences were found in the diet or feeding activity among the various size classes of shrimp specimens. It is hoped that these results will aid in the understanding of fluctuations of abundance, distribution, reproduction, growth rates, survival and other aspects of the biology of P. duorarum. (Ensignant) 72-10159

MEASUREMENT OF THE GROWTH RATES OF MYTILUS CALIFORNIANUS AND MYTI-LUS EDULIS IN MONTEREY HARBOR, Naval Postgraduate School, Monterey, Calif.

Available from the National Technical Informa-tion Service as AD-734 982, \$3.00 in paper copy, \$0.95 in microfiche. M. Sc Thesis, September 1971. 102 p, 8 fig, 1 tab, 9 ref, 1 append.

Descriptors: \*Mussels, \*Growth rates, \*Length, Volume, \*Temperature, Size, Age, Seasonal, Monthly, Annual. Identifiers: \*Monterey Harbor, \*Sea surface tem-

Growth rate measurements were made on the Mytilus californianus and Mytilus edulis species of the sea mussel in Monterey Harbor from August 1970 - August 1971. Plexiglass-stainless steel cages were used exposing the mussel populations to in-tertidal and subtidal conditions. Maximum length and average volume measurements were taken at monthly intervals. Both mussel species showed a close correlation between sea surface temperature and growth rate with characteristic growth patterns for each species. Growth rates varied as to ages and sizes of each species as well as varying monthly, seasonally and annually. (Ensign-PAI) W72-10160

STUDY OF THE POSSIBLE ROLE OF POLLU-TION IN THE PREVALENCE OF SEA NETTLES IN THE CHESAPEAKE BAY AND THE DEVELOPMENT OF A CENSUS TAKING METHOD.

Biospherics Inc., Rockville, Md.
For primary bibliographic entry see Field 05C. W72-10162

THE PRODUCTION OF ORGANIC DETRITUS IN A SOUTH FLORIDA ESTUARY.

Miami Univ., Fla. E. J. Heald.

Available from the National Technical Information Service as COM-71-01071, \$3.00 in paper copy, \$0.95 in microfiche. Sea Grant Technical Bulletin No 6, January 1971. 119 p, 20 fig, 5 tab, 94

Descriptors: \*Florida, \*Estuaries, \*Detritus, \*Plant physiology, \*Degradation, \*Productivity, \*Mangrove swamps, \*Grasses, Nutrients, Ecology, Food chains, Energy, Trophic level, Water pollution. ponution. Identifiers: \*Sawgrass, \*Black-rush.

The mechanisms and pathways by which dead plant material is incorporated into the aquatic system, thereby constituting an important energy source, are delineated and quantified. Estimations of the annual production of dead material by red mangrove, sawgrass, and blackrush were made. The mechanisms by which such material enters the detrital pool, the rate at which this proceeds, determination of the fluctuations in the quantity, nature and origin of the detrital load were ascertained along with the potential nutrient value of dead material, if consumed at any specific stage of decomposition. (Ensign-PAI) W72-10163

FISHERY RESOURCES ATLAS I - NEW YORK TO FLORIDA, Miami Univ., Fla.

E. J. Heald.

Available from the National Technical Informa-tion Service as COM-71-01069, 33.00 in paper copy, \$0.95 in microfiche. Sea Grant Technical Bulletin No 3, December 1970. 231 p, 118 ref, 2 ap-

Descriptors: \*Atlantic Ocean, \*Northeast U. S., \*Southeast U. S., \*Marine fisheries, \*Fisheries, Fish, Invertebrates, Surveys. Identifiers: \*Fishery locations, \*Species importance.

The location and importance of the principal fishery resources on the continental shelf of the eastern United States from New York to Florida are surveyed with emphasis on commercial fisheries. Information was obtained from published and unpublished sources and by consultation with fishery biologists and statisticians. Summaries have been prepared for species worth more than \$6,000 annually to fishermen in a state. Landing figures are given for 1956-1965 as a guide to the importance of a species to each state. Accuracy of in-formation varies from species to species and locality to locality. Fin Fish Data are presented in phylogenetic order of species according to current taxonomic classification. Invertebrates are listed by class. (Ensign-PAI) W72-10164

SURVEY OF MACROPHYTE RESOURCES IN

THE COASTAL WATERS OF ALASKA, Alaska Univ., College. Inst. of Marine Science C. P. McRoy, J. J. Goering, M. T. Gottschalk, M. Mueller, and S. Stoker.

Available from the National Technical Information Service as COM-71-01141, \$3.00 in paper copy, \$0.95 in microfiche. Report of Progress During First Year to the Sea Grant Program, Report No R71-6, May 1971. 42 p, 8 fig, 1 tab, 27 ref, ap-

Descriptors: \*Alaska, \*Natural resources, \*Grasses, \*Weeds, \*Aquatic weeds, \*Aquatic plants, \*Industrial crops, Density, Chemical Identifiers: \*Macrophytes.

The quantitative assessment of natural stocks of marine macrophytes (seaweed and seagrasses) in the coastal waters of Alaska was undertaken. The study hoped to determine the commercial value of macrophyte species from taking data on abundance and chemical composition, the collection and preparation of a reference herbarium of marine macrophytes and finally the compilation of data from the literature on the chemical composi-tion of Alaska marine macrophytes. Progress has been good and it is anticipated that the results will provide a background for the development of a new industry in Alaska. (Ensign-PAI) W72-10165

EXTENSION OF OCEANOGRAPHIC STUDIES IN PUGET SOUND AND THE NORTHEAST PACIFIC OCEAN.

Washington Univ., Seattle. Dept. of Oceanography.

Available from the National Technical Informa-tion Service as AD-735 954, \$3.00 in paper copy, \$0.95 in microfiche. Final Report, October 1963 through December 1969, Ref. No. A71-57, December 1971. 37 p, append. NR 083 012, Nonr

#### **Group 2L—Estuaries**

Descriptors: "Biology, "Phytoplankton, "Productivity, "Distribution patterns, "Marine animals, "Marine plants, "Detritus, "Sea water, "Chemistry, "Trace elements, "Metals, "Nutrients, Topog-Sedimentation, Dynamics, Currents

Identifiers: Eastern North Pacific, Eastern South Pacific, Arctic Ocean, Bering Sea, Caribbean Sea, Greater Antilles, Puget Sound, Brown Bear, Thomas G. Thompson.

Laboratory and field research was conducted from 1963 to 1969 in biology, chemistry, and physical oceanography. Statistical inference and experi-mental design in the collection and interpretation mental design in the collection and interpretation of oceanographic data was studied. These investigations were made by the research vessels Brown Bear and the Thomas G. Thompson in the Atlantic near the Greater Antilles, the Caribbean, the Bering Sea, and the eastern North Pacific and eastern South Pacific. Later, the water of Puget Sound and its approaches on the Washington and Oregon coast and the Columbia River were studied. The biological program stressed the quantita-tive aspects of production of phytoplankton in coastal waters. Seasonal and vertical distribution of plants, animals, and organic detritus in the water column were investigated in the Arctic. The chemical research included study of the chemistry of seawater, trace metal studies, distribution processes of minor elements and nutrients and the chemical aspects of oxygen-deficient and sulfidebearing basins and fjords. Bottom topography, sediments, sediment transport, interstitial water composition and chemical interactions between ater and mineral phases in the sediments were included in the geology program. The dynamics of water masses with emphasis on direct current measurements made up most of the research in physical oceanography. (Ensign-PAI) W72-10166

AN INCIDENCE OF FISH MORTALITY IN ATHANKARAI ESTUARY NEAR MANDAPAM, Central Marine Fisheries Research Inst., Mandapam (India). For primary bibliographic entry see Field 05C.

W72-10204

HYDROBIOLOGICAL STUDIES CALEDONIA (1965 MISSION OF THE FIRST ZOOLOGICAL INSTITUTE OF THE UNIVERSI-TY OF VIENNA): FRESH WATER AND BRACKISH WATER MOLLUSKS OF NEW BRACKISH CALEDONIA.

Vienna Univ. (Austria). Zoologisches Institut.

F. Starmuehlne

Cah O.R.S.T.O.M. (Off Rech Sci Tech Outre-Mer) Ser Hydrobiol. Vol 4, No 3/4, p 3-127, Illus, 1970,

English summary.
Identifiers: Anatomy, Brackish water, \*Distribution, Ecology, Fresh water, \*Mollusks, \*New

In 75 different inland-waters of New Caledonia, 34 spp. of mollusks were found: 31 spp. belong to the gastropods (26 spp. of Streptoneures and 5 spp. of Eulhyneures), 3 spp. belong to the bivalves. Three species of gastropods typically for brackish water or marine, are added. Ecological data, current velocity, temperature and chemistry of water are given. The shell measurements and variation, anatomy, ecology, biology and geographical distribution are described. The distribution of the tribution are described. The distribution of the freshwater-mollusks of New Caledonia in the different provinces of the island and in the different types of inland-waters is discussed. The zoogeographical position and the affinities of the New Caledonian freshwater-mollusks are discussed.--Copyright 1972, Biological Abstracts, Inc. W72-10219

POLLEN AND PALEOSALINITY ANALYSES FROM A HOLOCENE TIDAL MARSH SEQUENCE, CAPE MAY COUNTY, NEW JER-

Newark State Coll., Union, N.J.

For primary bibliographic entry see Field 02J. W72-10247

REPEATABILITY IN ESTUARINE HYDRAULIC

Virginia Inst. of Marine Science, Gloucester Point.

P. V. Hyer.

Journal of the Hydraulics Division ASCE, Vol 98. No HY4, Paper 8832, p 631-643, April 1972. 6 fig, 3 tab, 10 ref. append. OWRR C-1214 (No. 1597) (3).

Descriptors: "Hydraulic models, "Statistical methods, "Estuaries, "Hydraulic sililitude, "Mix-ing, Stratified flow, Stratification, Model studies, Laboratory tests, Salinity, Virginia. Identifiers: James River Estuary (Va).

To be useful as a research tool, a hydraulic model of an estuary must be capable of being brought to a steady state, in which the current, tidal height, and salinity at any point in space repeat themselves from one tidal cycle to the next at any given stage of the tide. The James River hydraulic model is located at the Waterways Experiment Station in Vicksburg, Miss. To determine the model's ability to reach a steady state in two tests run under identical conditions, salinity was sampled periodi-cally at a number of stations and the samples were analyzed. The standard deviation of the salinity at a particular station exceeds the limit of accuracy of the instrument. Tide generator aberration is primarily responsible for the observed fluctua-tions. The two tests run under identical conditions were examined statistically to determine the sig-nificance between the observed values of salinity in the two tests. The differences were found to be significant at the 5% level for 10 out of 26 stations. The freshwater inflow is relatively cool, resulting in a salinity inversion in the upstream reaches of the model. (Knapp-USGS) W72-10264

DISCHARGE MODEL OF THE MISSISSIPPI RIVER: EVALUATION OF THE IMPACT OF DIVERSION OF WATER TO TEXAS, Louisiana State Univ., Baton Rouge. Dept. of

Civil Engineering.
For primary bibliographic entry see Field 02E.
W72-10344

#### 03. WATER SUPPLY AUGMENTATION AND CONSERVATION

#### 3A. Saline Water Conversion

MULTIPLE-STAGE EVAPORATOR,

J. C. St. Clair. U.S. Patent No. 3,654,092, 5 p, 2 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 897, No. 1, p. 250, April 4, 1972.

Descriptors: \*Patents, \*Evaporators, Condensa-tion, Equipment, Separation techniques, \*Desalination, Water quality.

A twenty-stage vacuum evaporator is made from a series of 20 sloping sheets of polyester plastic film separated by 0.5 inch diameter pebbles. Pumps circulate the liquid solution evaporated over the upper surfaces of the plastic sheets and the liquid is evaporated by vapors contacting and condensing on the under surfaces of the sheets. Each sheet divides off a chamber that evaporates liquid at a successive lower pressure. Condensate is prevented from mixing by a series of short plastic prevented from mixing by a series of short plastic sheets, placed at a small angle with the horizontal than the larger sheets, that catch the condensate like shingles on a house and direct the condensate into bottom outlets. (Sinha-OEIS) W72-09790

LIQUID PURIFICATION SYSTEM, Puredesal, Inc., Levittown, Pa. (Assignee). W. E. Bradley.

U. S. Patent No. 3,654,148, 5 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 897, No. 1, p. 263, April 4, 1972.

Descriptors: \*Patents, \*Desalination, Water purification, Equipment, \*Reverse osmosis, \*Membranes, \*Dialysis, Separation techniques, Water

A reverse osmosis fluid treatment apparatus com prises: a membrene which separates relatively pure fluid from untreated fluid input material; and a system for supplying the untreated fluid to the membrane under pressure. A device is provided for storing the relatively pure fluid obtained from the membrane is a first storage container and for discontinuing the supply of untreated fluid to the membrane and simultaneously passing the relatively pure fluid through the membrane for further purification. By operating under a particular time sequence of fluid pressures and/or solutions have a first terms to the supplementations and chamical coming different concentrations and chemical compositions, the apparatus and in particular the reverse osmosis membrane are effectively rejuvenated for substantially continuous utilization. W72-09799

HOT BRINE SEEDING TECHNIQUE TO IN-CREASE FLASHING EFFICIENCIES IN MULTISTAGE FLASH EVAPORATORS, Department of the Interior, Washington, D.C.; and Secretary of the Interior, Washington, D.C. (As-

J. A. Hunter, and F. W. Gilbert. U. S. Patent No. 3,649,470, 2 p. 3 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 2, p. 709, March 14, 1972.

Descriptors: \*Patents, \*Desalination, Flash distillation, Evaporators, \*Brines, Distillation, \*Multistage flash distillation, Seawater.

A seeding technique provides for agitation and tur-nover by injecting into the lower portion of a distil-land a small amount of liquid at a temperature equal to or lower than the average distilland tem-perature. The liquid is injected transversely to the direction of flow of distilland and is directed perature. The liquid is injected transversely, directed direction of flow of distilland, and is directed toward the distilland-vapor interface. This results in improved flashing efficiency. An example illustrates that more water is produced for a given amount of heat transfer surface and vessel size. (Sinha-OEIS) W72-09812

VISCOSITY AND CONDUCTIVITY STUDIES. Miami Univ., Fla.
For primary bibliographic entry see Field 01B.
W72-09920

ION-SELECTIVE ELECTROCHEMICAL SEN-SORS--THIRD REPORT, Texas Instruments, Inc., Dallas.

I. Trachtenberg.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$0.60. Office of Saline Water Research and Development Progress Report No 761, March 1972. 54 p, 16 fig, 12 tab, 9 ref. OSW 14-01-0001-

Descriptors: \*Instrumentation, \*Desalination, \*Electrodes, \*Copper, \*Iron, \*Sulfates, Electrolytes, Calcium, Magnesium, Sea water. Identifiers: \*Ion selective electrodes, \*Sensors, \*Chalcogenides, \*Oxy-Chalcogenides, \*Doped silicon seasor. Colcium [Institute of the colling of icon sensor, Calcium fluoride.

The development of good solid state sensors for Ca+2 and Mg+2 appears within reach. Some modifications to the crystal growing process are necessary to insure the proper conductivity and to provide microcrack-free material. Surface treatment for enhanced response has not been investigated. A few preliminary experiments with doped CaF2 indicate that considerable progress toward obtaining good sensors could be achieved by proper surface conditioning. There is a problem of selectivity between Ca+2 and Mg+2; however, the initial difficulty to be overcome is obtaining a high selectivity for the divalent ions in the sence of monovalent ions. Progress is being made in achieving these goals. Sensors produced from CuO-As2S3 material have very selective response to Cu+2 in a variety of electrolytic media. There is essentially no interference from other monovalent (Na+, K+, H+) ions or from many of the divalent (Ca+2, Mg+2, Ni+2, Fe+2, Pb+2, Mn+2) ions. There is an effect of anions, notably a considerable change in response between NO3- and Cl- media. This is the result of complex formation and stabilization of the Cu+1 oxidation state in Cl-. However, these sensors can monitor Cu+2 in a complicated electrolyte such as sea water. (OSW)

THE ROLE OF SURFACE CHEMISTRY IN THE REMOVAL OF COLLOIDAL POLLUTANTS BY MICROFLOTATION, Clarkson Coll. of Technology, Potsdam, N.Y.

For primary bibliographic entry see Field 05D. W77-09922

ANALYSIS AND SUMMARY OF REPORTS AND DATA FROM THE FREEPORT, TEXAS, TEST

BED PLANT (1961-1969), Control Systems Research, Inc., Arlington, Va. G. H. Shroff, I. C. Watson, and R. D. Cross. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$3.25. Office of Saline Water Research and Development Progress Report No. 759, December 1971. 364 p, 72 tab, 71 fig. OSW 14-30-

Descriptors: \*Sea water conversion, \*Multiple-effect, Long-tube vertical, Falling-film evaporation, Saline water, Distillation, Boiling, Condensing, Deaeration, Heat transmission, Heat exchangers, Heat recovery, Heat transfer coefficients, Fluid flow, Centrifugal pumps, Evaporators, Deaerators, Desalination.

ldentifiers: Process development, Plant operation and maintenance materials performance, En-gineering economics of sea water conversion, Heat and material balance.

multiple-effect falling-film-evaporation method of desalination is discussed. Most of the data are derived from development studies. Technical, logistical, and economical evaluations are presented, also the process and mechanical development program results are related to the Vertical Tube Evaporator (VTE) process in particular, and desalination in general. Actual capital and operating costs are presented and compared to theoretical 'normalized' capital and operating costs. Production and maintenance cost averages are presented; relevant operating and maintenance experiences are discussed. A thorough technical evaluation of the performance of the process, the mechanical equipment, and the construction materials is included. (OSW)

#### 3B. Water Yield Improvement

EFFECTS OF CULTURAL CHANGES ON MAKARA EXPERIMENTAL BASIN: HYDROLOGICAL AND AGRICULTURAL PRODUCTION EFFECTS OF TWO LEVELS OF GRAZING ON UNIMPROVED AND IMPROVED SMALL CATCHMENTS, Ministry of Works, Wellington (New Zealand). Water and Soil Div.

For primary bibliographic entry see Field 04C.

W72-09878

re

GREAT LAKES SNOW REDISTRIBUTION RESEARCH PROJECT (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT. National Oceanic and Atmospheric Administration, Rockville, Md.

Available from the National Technical Informa-tion Service as PB-204 158D, \$3.00 in paper copy, \$0.95 in microfiche. November 15, 1971. 17 p.

Descriptors: \*Cloud seeding, \*Great Lakes, \*Snow management, \*Environmental effects, Snowfall, Snow weather, Environmental control, Research and development, Comprehensive planning, Administrative decisions, Water management (Applied), International waters, Cloud cover, United States, Canada, Silver iodide, New York (1998) Identifiers: \*Environmental impact statements.

The Great Lakes Snow Redistribution Research Project, conducted by the National Oceanic ar Project, conducted by the National Oceanic and Atmospheric Administration, is directed primarily at assessing the possibility of moderating exces-sive snowfall along the leeward side of the Great Lakes by overseeding cloud systems with dry ice and silver iodide. This pulsed seeding is designed to produce a seeded portion of cloud 20 to 40 miles long which can be detected from ground and aire observation stations as well as radar. So prior research has been completed on this project and United States-Canadian coordination has been achieved. Any environmental effects will be highly transient and limited to localized areas. Since the actual seeding will be limited to short time periods it is unlikely that any increased accumulation will represent more than a small portion of the total snowfall at any location. No known adverse effects are expected from silver iodide concentrang from seeding. The direct effect on humans will be well within allowable limits. There is no alternative to conducting the tests under con-trolled and monitored conditions in the natural en-vironment. (Widman-Florida)

HERBICIDAL CONTROL OF AQUATIC

PLANTS, Office of the Chief of Engineers, Washington, E. O. Gangstad.

Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol. 98, No. SA2, p 397-406, 1972. 3 tab, 9 ref.

Descriptors: \*Herbicides, \*Aquatic weed control, Application methods, Cattails, Costs, Environ-mental effects, Toxicity, 2 4-D, Water hyacinth. Identifiers: Nymphaea odorata, Brasenia schreberi, Zizaniopsis miliacea, Residue levels.

Major environmental factors require proper precautions be applied in the chemical control of aquatic weeds. These problems can be obviated by the choice of herbicide and method of application. In addition to the 2,4-D acid itself, a number of its derivatives are available in several formulations, including amine, sodium, and ammonium salts and some alkyl and aryl esters. Commercial prepara-tions in liquid, powder, dust, and pellet form are obtainable in water-soluble and oil-soluble forms. The dimethylamine salt of 2,4-D is biodegradable and is rapidly dissipated after application. When extreme infestation occurs in small impoundments and where there is a hazard of deoxygenation, ap-plication procedure includes one or more of the following: obnoxious growths are treated at or near feeder areas; growths are trapped in small quantities and treated; retreatment is made about 8 weeks following the first application; treatment of only 25% to 50% of infestations at one time; and allowing dead plants to sink before treating adjacent live plants. Cost of hyacinth control operations vary with the amount and density of infestation, with type of equipment used, with character of the area, and often with weather conditions. Studies have shown that 2,4-D dimethylamine is not particularly toxic to fish. (Jones-Wisconsin)

GROUND-WATER RESOURCES OF NATRONA COUNTRY, WYOMING, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 02F. For primar; W72-10343

#### 3C. Use of Water of Impaired Quality

STUDIES ON THE EFFECTS OF SALINE IR-RIGATION WATERS ON THE PHYSICO-CHEMICAL PROPERTIES OF SOME SOILS OF RAJASTHAN, Udaipur Univ. (India). Coll. of Agriculture. For primary bibliographic entry see Field 02G.

EFFECTS OF IRRIGATION WITH SEWAGE ON FERTILITY OF SOD-PODZOLIC SANDY LOAM SOILS (VLIYANIYE OROSHENIYA STOCHNYMI VODAMI NA PLODORODIYE DERNOVO-PODZOLISTYKH SUPESCHANYKH POCHV), V. T. Dodolina.

Pochvovedenive, No 10, p 65-73, October 1971, 5

Descriptors: \*Land reclamation, \*Podzols, \*Irrigation practices, \*Irrigation effects, \*Return flow, Waste water (Pollution), Industrial wastes, Domestic wastes, Sewage effluents, Soil properties, Humus, Nitrogen, Acidity, Salts, Grasses

Identifiers: \*USSR, \*Moscow Oblast, \*Sod-pod-

Studies on use of sewage-polluted water to irrigate Sod-Podzolic sandy loam soils of the Western Meshchera Lowland (Noginsk Rayon, Moscow Oblast) were based on 5 years of experiments by the Central Scientific Research Station for Agricultural Use of Sewage. Irrigation with industrial and domestic wastes increased humus content of soil top layers by 0.2% or more and total nitrogen by 0.02%-0.03%, reduced soil acidity, and improved soil structure. Irrigation with sewage was beneficial to growth and development of perennial grasses, the yield being directly related to composition and fertilizinzing value of the sewage. Grass yield was highest when domestic waste water (282 cntr/ha), mixed sewage (264 cntr/ha) and waste water from a chemical phar-maceutical plant (267 cntr/ha) were used and was 1.5-2 times that in the irrigated control. (Josefson-USGS) W72-10259

SEASONAL VARIATIONS IN THE SALT COM-POSITION OF SOME SALINE WATER-I-RRIGATED SOILS OF WESTERN RAJASTHAN: I. EFFECT OF RAINFALL, Central Soil Salinity Research Inst., Karnal (In-

For primary bibliographic entry see Field 02G.

# 3F. Conservation in Agriculture

SOLAR DISTILLATION IRRIGATION AP-PARATUS, L. V. Howard.

U. S. Patent No. 3,653,150, 4 p, 6 fig, 10 ref; Official Gazette of the United States Patent Office. Vol. 897, No. 1, p. 27, April 4, 1972.

Descriptors: \*Patents, \*Irrigation, \*Irrigation effi-ciency, \*Crop production, Solar distillation, Water purification, \*Evaporation, \*Transpiration, Water loss, \*Conservation, Agriculture, Water distribution (Applied).

A method is provided for covering a crop with a transparent plastic sheet and using it with existing solar energy to cause cyclic evaporation, distrubu-

# Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

#### Group 3F-Conservation in Agriculture

tion and condensation of water beneath the covered area. Water loss due to evaporation-transpiration is greatly reduced. The side panels of the plastic cover contain water tubes which are drawn through a water filled trough in the ground at the same time with the covering operation to facilitate movement of the cover over its supporting strucwater level is lowered so as to tighten the cover down upon the structure. (Sinha-OEIS)

STOMATAL MOVEMENTS, FREQUENCIES, AND RESISTANCES IN TWO MAIZE VARIETIES DIFFERING IN PHOTOSYNTHETIC CAPACITY, Connecticut Agricultural Experiment Station,

New Haven. G. H. Heichel

J Exp Bot. Vol 22 No 72 p 644-649. 1971. Illus. Identifiers: Abaxial, Adaxial, Capacity, Diffusion, Epidermis, Frequencies, Illumination, \*Maize-M, Mesophyll, Movements, Periodicity, \*Photosynthesis, Porometer, Resistances, \*Sto-

The stomatal characteristics of 2 maize varieties previously found to differ in rates of net photosynthesis were examined in a controlled environment. Measurements with a ventilated diffusion porometer showed that I variety exhibited a pronounced and the other a weak periodicity in stomatal resistance of the adaxial epidermis. At equal illumination the stomatal resistance of the adaxial epidermis decreased from upper to lower leaves, while the resistance of the abaxial epidermis changed in the opposite manner. Stomata on the adaxial and abaxial surfaces of maize leaves exhibited random, not compensatory, movements in a constant environment. The variety with the lesser stomatal frequency and higher total leaf resistance to water loss had nevertheless faster net photosynthesis than the variety with the greater stomatal frequency, demonstrating importance of the so-called mesophyll resistance.-Copyright 1972, Biological Abstracts, Inc.
W72-09938

LIVESTOCK WASTE MANAGEMENT AND POLLUTION ABATEMENT. For primary bibliographic entry see Field 05G.

CROP PRODUCTION AND SOIL ANALYSES AS AFFECTED BY APPLICATIONS OF CATTLE FEEDLOT WASTE, Southwestern Great Plains Research Center,

Bushland, Tex. For primary bibliographic entry see Field 05D. W72-10004

EFFECT OF MANURE HANDLING SYSTEMS ON PLANT NUTRIENT CYCLING, Wisconsin Univ., Madison. Dept. of Soil Science. For primary bibliographic entry see Field 05C. W72-10011

CENTER-PIVOT SPRINKLER DESIGN BASED ON INTAKE CHARACTERISTICS,
Texas A and M Univ., College Station; and Soil
Conservation Service, Temple, Tex.
R. C. Dillon, Jr., E. A. Hiler, and G. Vittetoe.
Paper 71-759, American Society of Agricultural ineers 1971 Winter Meeting, Chicago, Ill, Dec 1971. 27 p, 9 fig, 6 tab, 8 ref.

Descriptors: \*Sprinkler irrigation, \*Surface ru-noff, \*Irrigation design, \*Absorption, Design, Design criteria, Soil-water relationship, Water distribution (Applied), Water utilization, Irrigation efficiency, Root zone, Irrigated land, Characteristics, Crops, Rotation, Surface storage, Soil types, Slopes, Velocity, Irrigation.

Identifiers: \*Water application rate, Soil storage capacities, Water retention, Soil-water relationship.

A procedure is developed enabling an engineer to design a center-pivot sprinkler irrigation system that will meet crop requirements without surface runoff. Equations are derived and design curves presented for determining peak water use, speed of travel, time per revolution, depth of application, discharge from water source, and length of the system. The procedure matches a system to a particular soil by determining the system to a particular soil by determining the minimum speed of travel from the soil intake characteristics and the allowable surface storage. Potential runoff from the soil occurs when the allowable surface storage of the soil is satisfied. Values for the allowable surface storage for various slopes are given. Numerical values are given in the tables for: (1) peak water use rates for various crops, (2) irrigation efficiencies for various crops and climates, (3) feeder root depth of different crops, (4) soil storage capacity for different soils, and (5) sprinkler intake equations for different soils. This procedure is exemplified for a 180-acre square field. (USBR)

THE INFLUENCE OF WEATHER, CROP AND SAMPLING DEPTH ON THE MEASUREMENT OF PORE SIZE DISTRIBUTION IN THE ARA-BLE LAYER OF SOME CULTIVATED SILT SOILS,

Riiksfaculteit der Landbouwwetenschappen. Ghent (Belgium).
For primary bibliographic entry see Field 02G.
W72-10117

CROP RESPONSE TO MIST IRRIGATION, Texas A and M Univ., College Station.
T. A. Howell, E. A. Hiler, and C. H. M. Van Bavel.
Transactions, American Society of Agricultural
Engineers, Vol 14, No 5, p 906-910, Sept-Oct 1971.
8 fig, 3 tab, 17 ref.

Descriptors: \*Mist irrigation, \*Crop response, \*Vegetable crops, \*Evapotranspiration control, \*Evapotranspiration, Bibliographies, Mist, Texas, Irrigation efficiency, Lysimeters, Soil-water-plant relationships, Plant growth, Crops, Microcli-matology, Irrigation engineering, Irrigation, Agriculture, Crop production. Identifiers: Leaf stomata, Soil-water relationship.

In the future, agriculture may be denied the luxury of an abundant supply of irrigation water. Con-sequently, more efficient irrigation methods must be developed. During the 1970 growing season, the Agricultural Engineering Research Lab, Texas A and M Univ, investigated the response of southern peas to mist irrigation. The experiment was con-ducted in a sheltered lysimeter installation in which complete control of the soil water balance was maintained. Numerous crop, soil, and meteorological parameters were measured and evaluated to determine growth response of the crop. In one experiment, leaf water potential increased by 3.4 bars after 5 min of misting; the average leaf temperature was reduced 4.0 deg C. e various mist treatments described, the yield of freshly harvested pods increased from 10 to 60% compared with yields from nonmisted, but surface irrigated controlled experiments; the yield of dry material was increased 20 to 38%. Test results showed that mist irrigation effectively controlled the plant water balance and relieved inter-nal water deficits, resulting in a yield response of nai water deficits, resulting in a yield response of up to 60% under conditions similar to those in a natural field. The misting treatment also greatly in-creased the efficiency of soil water utilization. (USBR)

PROGRESS REPORT OF RESIDUE STUDIES ON DICAMBA USED FOR DITCHBANK WEED Rureau of Reclamation, Denver, Colo.

H. A. Salman, T. R. Bartley, and A. R. Hattrup. Bureau of Reclamation Report REC-ERC-72-6, Feb 1972. 13 p, 8 fig, 3 tab, 12 ref.

Descriptors: \*Herbicides, \*Weed control, \*Soil analysis, \*Chemical analysis, \*Water analysis, \*Pesticide residues, Irrigation canals, Gas chromatography, Treatment, Rates of application, On-site tests, Irrigation water. Identifiers: South Columbia Basin Irrigation, Columbia Basin Project (Wash), Test results.

The dimethylamine salt of dicamba was applied in the fall of 1970 to 4 dewatered laterals on the South Columbia Basin Irrigation District. The herbicide residues of dicamba and 5-hydroxy dicamba were determined in ditchbank and ditchbottom soils and in the first irrigation water released through the treated laterals in the spring. Solvent extraction, followed by gas chromatography, was used to measure the herbicide residues. Levels of dicamba in the irrigation waters measured from 0 to 1.6 ppb. Ditchbank soils ranged from 0 to 1.03 ppm; ditchbottom soils measured 0 to 0.24 ppm. No 5-hydroxy dicamba was found in the irrigation waters or soils. Dicamba slowly leached into the 6to 12-in. soil depths during the winter. Good control of broad-leaved annuals was achieved the fol-lowing summer on all treated laterals. (USBR) W72-10128

**BIPHASIC CHARACTER OF CHANGES IN THE** VISCOSITY OF PROTOPLASM OF PLANT CELLS UNDER CONDITIONS OF WATER DEFICIENCY, (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Inst. of Plant Physiology. For primary bibliographic entry see Field 02I. W72-10147

INVESTIGATION OF THE WATER STATUS IN PLANT TISSUES BY THE NUCLEAR-SPI-N-ECHO METHOD (IN RUSSIAN), Kazan Agricultural Inst. (USSR). For primary bibliographic entry see Field 02I.

#### 04. WATER QUANTITY MANAGEMENT AND CONTROL

#### 4A. Control of Water on the Surface

EFFECTS OF CULTURAL CHANGES ON EXPERIMENTAL BASIN: MAKARA HYDROLOGICAL AND AGRICULTURAL PRODUCTION EFFECTS OF TWO LEVELS OF GRAZING ON UNIMPROVED AND IMPROVED SMALL CATCHMENTS, Ministry of Works, Wellington (New Zealand). Water and Soil Div. For primary bibliographic entry see Field 04C.

FLOOD HAZARD EVALUATION GUIDELINES FOR FEDERAL EXECUTIVE AGENCIES. Water Resources Council, Washington, D.C. For primary bibliographic entry see Field 06E. W72-09888

A MODEL FOR A LINKED SYSTEM OF MUL-TI-PURPOSE RESERVOIRS WITH STOCHASTIC INFLOWS AND DEMANDS, TexasA and M Univ., College Station. Water Resources Inst. For primary bibliographic entry see Field 02H.

CARBON HILL WATERSHED, MONTANA (DRAFT ENVIRONMENTAL IMPACT STATE-MENT).

Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 08A. W72-09898

SOUTH BRANCH, RAHWAY RIVER, NEW JERSEY FLOOD CONTROL PROJECT, RAHWAY, NEW JERSEY (DRAFT ENVIRONMENTAL IMPACT STATEMENT).
Army Engineer District, New York.
For primary bibliographic entry see Field 08A.

MAINTENANCE OF THE NEWARK BAY, HACKENSACK AND PASSAIC RIVERS NAVIGATION PROJECT (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, New York

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Available from the National Technical Informa-tion Service as PB-205 337D, \$3.00 in paper copy, \$0.95 in microfiche. December 29, 1971. 11 p, 5

Descriptors: \*Dredging, \*Environmental effects, \*Channel improvement, \*Navigable waters, Administrative agencies, Industrial wastes, Project planning, Transportation, Cities, Safety, Oil spills, Aquatic life, Sewage effluents, Impaired water quality, Economic justification, Economic impact, Maintenance, \*New Jersey. Identifiers: \*Environmental impact statements, Newark Bay (N.J.), \*Hackensack River (N.J.), \*Passaic River (N.J.).

This proposed navigation project is necessary to satisfy growing demands for shipping facilities in satisty growing demands for shipping facilities in the Newark Bay area. The project will consist of maintenance dredging and will assure continued low commodity transportation costs and improved channels. Dredging of channels and maneuvering spaces will yield direct economic benefits to residents within the New York-New Jersey metropolitan area. The greater safety of the channels will benefit business and residents in the area by decreasing the changes of collisions and oil spilby decreasing the chances of collisions and oil spil-lage. Fish and wildlife resources in the area are of negligible value as a result of the pollution caused by industrial and commercial activity and the discharge of sanitary effluent. The dredging operation may cause short-term turbidity and noxious odors. Dredged material will be disposed of at sea. (Waldron-Florida) W72-09902

ENVIRONMENTAL LAW-LANDFILL PERMIT REQUIREMENTS--THE CORPS OF ENGINEERS DOES AN ABOUT FACE (ZABEL V. TABB, 430 F.2D 199 (5TH CIR. 1970)), L. M. MacCracken.

Kentucky Law Journal, Vol 59, p 748-755, 1971. 36

Descriptors: \*Dredging, \*Permits, \*Rivers and Harbors Act, \*Environmental effects, \*Navigable waters, Judicial decisions, Legal review, Water law, Legal aspects, Fish, Legislation, Harbors, Navigation, Estuaries, Administration, Project planning, Administrative agencies, Administrative decisions, Adoption of practices, Aquatic habitats. Identifiers: \*Fish and Wildlife Coordinating Act, \*National Environmental Policy Act.

Plaintiffs sought a dredge and fill permit from the Corps of Engineers pursuant to the Rivers and Harbors Act. The Corps concluded the operations would not interfere with navigation, but refused the permit on the basis that unavoidable ecological damage to the bay's marine life would ensue. Plaintiffs argued the Corps lacked authority to deny a permit on ecological grounds. The district court granted summary judgment for plaintiffs. The appellate court reversed holding that the Fish and Wildlife Act and the National Environmental Policy Act authorized the Corps to deny a permit on ecological grounds. The court, basing its deci-sion mainly on the Wildlife Act, reasoned that in light of Congress' environmental concern ex-pressed in that Act it would be ludicrous not to expressed in that Act it would be ludicrous not to ex-pect cooperation from the only agency authorized to license dredging operations. The case is deemed important in confirming the Congressional intent of environmental protection. However, while the court acknowledges the authority of the Corps to deny a permit for environmental protection, it is silent as to the Corps' obligation to use this authority. The omission by the court of the role of the public in enforcing environmental rights is the public in enforcing environmental rights is criticized. (Ilkson-Florida)

NAVIGATION PROJECT, MISSISSIPPI RIVER, FORT MADISON, IOWA. COMMERCIAL BOAT HARBOR, FORT MADISON, IOWA (FINAL ENVIRONMENTAL IMPACT STATE-

Army Engineers District, Rock Island, Ill.

Available from the National Technical Informa-tion Service as PB-199 450F, \$3.00 in paper copy, \$0.95 in microfiche. May 1971. 23 p.

Descriptors: \*Environmental effects, \*Iowa, \*Channel improvement, \*Mississippi River, Navigable rivers, Rivers and Harbors Act, Navigable rivers, Rivers and Harbors Act, Streambeds, Navigation, Cost-benefit analysis, Federal government, Feasibility studies, State governments, Industrial wastes, Economic im-pact, Channels, Dredging, Water quality, Turbidi-ty, Project planning, Spoil banks. Identifiers: \*Environmental Impact Statements, \*Fort Madison (Iowa).

This navigation project on the Mississippi River will provide a commercial channel and maneuver-ing area from the main navigation channel of the river to the Fort Madison industrial area. Canalization will be by hydraulic-dredge method, with material disposed on shore and confined by retain-ing dikes. Since the aquatic environment being considered is immediately downstream from Fort Madison, the overall quality of the water is only fair. Dredging will destroy existing bottom life and disturb higher forms of aquatic life. A temporary increase in turbidity is expected. The three soil disposal areas consist of 404 acres of varying kinds of land. Potential environmental damage will be greatly outweighed by the resulting economic benefit. Suggestions are made for repairing environmental damages resulting from project construction. There has been opposition to the project by environmental groups. Comment was solicited from appropriate state and federal agencies and responses are included in the statement. (Waldron-W72-09916

MODIFIED HACKNEY FLOODWAY AND CLO-MODIFIED HACKNEY FLOODWAY AND CLO-SURE OF MISSION FLOODWAY, LOWER RIO GRANDE FLOOD CONTROL PROJECT, TEXAS (FINAL ENVIRONMENTAL IMPACT STATEMENT). International Boundary and Water Commission,

Available from the National Technical Information Service as PB-201 090F, \$3.00 in paper copy, \$0.95 in microfiche. November 1971. 27 p, 1 map.

Descriptors: \*Environmental effects. \*International Bound. and Water Comm., \*Floodways,
\*Rio Grande River, \*Flood control, Mexico, International law, Levees, Weirs, Floods, Floodwater, Sediments, Channels, Wildlife habitats, Archaeology, \*Texas, Rivers.
Identifiers: \*Environmental Impact Statements, \*Lower Rio Grande Flood Control Project (Tex.).

The proposed unit is a modification to the existing U.S. portion of the International Flood Control Project and will provide a greater degree of flood protection to U.S. lands. The improvements will require clearing natural vegetation, constructing a weir and pilot channel, and modifying and constructing levees. The clearing of 66 acres from a 703-acre brush habitat owned by a private wildlife refuge will be mitigated by commitment of 380 acres of nearby brushlands to wildlife management. Some highly productive farm and pasture lands will be lost. Minor temporary interference with transportation and temporaryturbidity effects on fisheries will be experienced during construction. This project will eliminate serious flood damage. It is not known whether archeological sites exist in the project area. Appropriate provisions will be included in project specifications requiring compliance with environmental regulations. The alternate chosen was economically and technically the most feasible agreed on by Mexico and the U.S.; it also disturbed the smallest area of habitat. Agency comment and a detailed map of the project are included. (Ilkson-Florida) W72-09918

PREFABRICATED SUBSURFACE DRAINS, Connecticut Univ., Storrs. For primary bibliographic entry see Field 08A.

WATER MOVEMENT IN A FIELD SOIL DUR-ING DRAINAGE AND SUBIRRIGATION, North Carolina State Univ., Raleigh. R. W. Skaggs, G. J. Kriz, and R. Bernal. Paper 71-713, American Society of Agricultural Engineers 1971 Winter Meeting, Chicago, Ill, Dec 1971. 19 p, 1 tab, 6 fig, 16 ref.

Descriptors: \*Subsurface drainage, \*Subsurface irrigation, \*Controlled drainage, \*Drainage systems, \*Groundwater movement, \*Groundwater recharge, Subsurface drains, Water table, Water levels, Bibliographies, Water level fluctuations. tions, Groundwater management, Drainage en-gineering, On-site tests, Test results. Identifiers: \*Subsurface flows, Drain spacing,

Field tests were conducted to determine the water retable movement for a subirrigation-drainage system on a Fallsington fine sandy loam soil. Results of the water table response to subirrigation, drainage, and rainfall infiltration boundary conditions for tile spacings of 7.5, 15, and 30 m are presented. Drain spacings, computed from 2 presented. Drain spacings, computed from 2 theoretical equations, were compared to actual spacings. Results of the experiments showed that water could be supplied to the root zone at a more than sufficient rate to supply plant needs for the 7.5 and 15 m tile spacings. However, the response was too slow for the 30 m tile lines, which took 74 hr for the water table at the midpoint between tile lines to raise sufficiently high for subirrigation. Closer spacing of the drains is required in this type of soil. For subirrigation conditions in which the water table is held at a shallow depth, the application of rainfall will result in a significant rise in the tion of rainfall will result in a significant rise in the water table elevation. The total rise and response time of the water table will depend on initial depth, the amount of rainfall, and the soil hydraulic properties. Drain spacings required for a given draw-down rate can be more accurately predicted by the van Schilfgaarde equation than by the Glover equations for the soil used in this study. (USBR) W72-10122

SUGAR AND BRIAR CREEKS PROJECT, CATAWBA RIVER BASIN, NORTH CAROLINA AND SOUTH CAROLINA (DRAFT ENVIRON-MENTAL IMPACT STATEMENT). Army Engineer District, Charleston, S.C. For primary bibliographic entry see Field 06E. W72.1012 W72-10175

COLUMBIA DRAINAGE AND LEVEE DISTRICT NO. 3, MONROE COUNTY, ILLINOIS

#### Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4A-Control of Water on the Surface

(DRAFT ENVIRONMENTAL IMPACT STATE-

MENT). Army Engineer District, St. Louis, Mo. For primary bibliographic entry see Field 06E. W72-10176

KIND V. JOHNSON CITY (LIABILITY FOR AL-TERING THE NATURAL DRAINAGE FLOW OF SURFACE WATER).

For primary bibliographic entry see Field 06E. W72-10183

SUN RIVER FLOOD CONTROL PROJECT, SUN RIVER, GREAT FALLS, MONTANA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, Omaha, Nebr. For primary bibliographic entry see Field 06E. W72-10186

TREXLER LAKE PROJECT, JORDAN CREEK, PENNSYLVANIA (DRAFT ENVIRONMENTAL IMPACT STATEMENT).
Army Engineer District, Philadelphia, Pa.

For primary bibliographic entry see Field 06E. W72-10187

THE OOLENDY RIVER WATERSHED PRO-

JECT, SOUTH CAROLINA (ENVIRONMENTAL IMPACT STATEMENT).
Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 08A.
W72-10189

THE PERMISSIBLE EXTENT OF RIPARIAN

LAND, For primary bibliographic entry see Field 06E.

EARTHLOAD ON FLEXIBLE PIPES, (IN NOR-

WEGIAN), Norges Landbrukshoegskole, Vollebekk. For primary bibliographic entry see Field 08A. W72-10225

URBAN HYDROLOGY.

For primary bibliographic entry see Field 04C. W72-10284

SALT DISCHARGE DURING DRAINAGE BASED ON PIEZOMETRIC OBSERVATIONS IN THE NORTHERN MUGAN REGION (SOLEVOY STOK PRI DRENAZHE PO DANNYM PYEZOMETRICHESKIKH NABLYUDENIY V SEVERNOY MUGANI), Azerbaidzhanskii Nauchno-Issledovatelskii In-

stitut Gidrotekhniki i Melioratsii, Baku (USSR).

Pochvovedeniye, No 10, p 74-82, October 1971. 7 tab. 10 ref.

Descriptors: \*Land reclamation, \*Salts, \*Salinity, \*\*Drainage, \*Drainage systems, Draina, Drainage water, Groundwater, Confined water, Zone of aeration, Water quality, Water levels, Water level action, water levels, water levels, water levels fluctuations, Transmissivity, Porosity, Artesian aquifers, Groundwater recharge, Observation wells, Piezometers, Weirs.
Identifiers: \*USSR, \*Azerbaydzhan, Mineraliza-

Investigations were conducted in 1966-67 in the northern Mugan region of Azerbaydzhan to study behavior of drainage water on plots differing in hydrogeological conditions and water-reclamation characteristics. A comparison was made between artesian flow calculated from piezometric data and drainage flow determined from weirs at the head and mouth of a drain. Without irrigation water or ample precipitation in the aeration zone, drailage systems removed 670-1,030 cu m of water/ha and 46-71 metric tons of salts/ha a year. Artesian waters and subsurface waters from underlying layers were the principal sources of groundwater recharge. (Josefson-USGS) W72-10306

WEST VIRGINIA'S BUFFALO CREEK FLOOD: A STUDY OF THE HYDROLOGY AND EN-GINEERING GEOLOGY, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 08B. W72-10353

#### 4B. Groundwater Management

METHOD AND ARRANGEMENT FOR PURIFY-ING WATER DRAWN FROM A GROUND--WATER WELL, For primary bibliographic entry see Field 05F. W72-09815

CONJUNCTIVE USE OF SURFACE AND GROUND WATER IN URBAN WATER SUPPLY, Office of Science and Technology, Washington, D.C.

For primary bibliographic entry see Field 06B. W72-10103

DIGITAL COMPUTER SIMULATION FOR SOLVING MANAGEMENT PROBLEMS OF CONJUNCTIVE GROUNDWATER AND SUR-FACE WATER SYSTEMS, Resources for the Future, Inc., Washington, D.C.

R. A. Young, and J. D. Bredehoeft. Water Resources Research, Vol 8, No 3, p 533-556, June 1972. 10 fig, 8 tab, 37 ref.

Descriptors: \*Conjunctive use, \*Surface-ground-water relationships, \*Simulation analysis, \*Water water relationships, \*Simulation analysis, management (Applied), Mathematical models, Op-timum development plans, Water resources development, Hydrogeology, Stochastic processes. Identifiers: South Platte River (Colo).

In river basins where aquifers are intimately associated with streams, the unrestricted development of groundwater can reduce streamflows and jeopardize the rights to the flow of surface water. A simulation model was developed to aid in the solution of such problems. The model is composed of (1) a hydrologic model that represents the physical response of the stream-aquifer system to changes in river flows, diversions, and pumping, and treats streamflow as a stochastic input and (2) an economic model that represents the response of irrigation water users to variations in water supply and cost. These elements were incorporated into a decision framework so that the net income to the water resource system associated with alternative management schemes could be measured. The results of operating the model with parameters representing conditions in the South Platte Valley of eastern Colorado under alternative institutional and hydrologic conditions are reported. (Knapp-USGS) W72-10283

#### 4C. Effects on Water of Man's Non-Water Activities

EFFECTS OF CULTURAL CHANGES ON MAKARA EXPERIMENTAL BASIN: HYDROLOGICAL AND AGRICULTURAL PRODUCTION EFFECTS OF TWO LEVELS OF GRAZING ON UNIMPROVED AND IMPROVED SMALL CATCHMENTS,
Ministry of Works, Wellington (New Zealand).
Water and Soil Div.

M. E. Yates. Journal of Hydrology (New Zealand), Vol 10, No 1, p 59-84, 1971. 20 fig, 5 tab, 1 ref. Descriptors: \*Peak discharge, \*Water yield, \*Pasture management, \*Grazing, \*Carrying capacity, Water conservation, Soil conservation, Grasslands, Land management, Range management, Runoff, Rainfall-runoff relationships.

Identifiers: \*New Zealand.

The effects of hard and lax grazing of unimproved and oversown and topdressed pastures on small catchments of 0.6-1.5 hectares are discussed. catchments of 0.6-1.5 hectares are discussed. Oversowing and topdressing resulted in a trebling of pasture production and, when hard grazed, a trebling of stock-carrying capacity. Under lax grazing, the stock-carrying capacities of both unimproved and improved pastures were reduced to two-thirds of those under hard grazing. Oversowing and topdressing decreased annual runoff, increased a surface detailing a set of the state of the increased surface detention, reduced the number of days on which flow occurred, and reduced the percentage of occurrence of given daily runoffs percentage of occurrence of given daily runoffs over the greater part of the flow range. Individual hydrographs show no decrease in rise time but an increase in lag and depletion time, decreased flow before the peak, decreased peak discharges and decreased runoff. The magnitude of these changes was greater when the improved pastures were lax grazed. (Knapp-USGS) W72-09878

WATERFOWL MANAGEMENT AND HAR-VESTING,

Chambers County, Anahuac, Tex.

J. Lagow. In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p 27-31.

Descriptors: \*Waterfowl, \*Marsh management, \*Harvesting, Marshes, Hunting, Texas, Ducks (Wild), Burning.

In spite of population pressures, the marshes and estuaries of the upper Texas Coast still afford inviting wintering grounds for waterfowl. Nevertheless, sound management practices are necessary if Texas expects to hold the great number of water-fowl that migrates into the state each fall. A major rowin that migrates into the state each rail. A major problem faced by many waterfowl areas is con-trolling the water levels in the marshes. This problem was created by the increasing urbaniza-tion of the area. To maintain and regulate the water level and to provide for an adequate growth of duck food, it may be necessary to cut some canals and to install water gates. Duck food is a very important factor in waterfowl management. Without adequate food, ducks and geese move to other areas, so every effort needs to be made to maintain adequate feeding grounds. Another important factor in management is marsh burning, which is important for controlling undesirable grasses, weeds, and excess growth vegetation. Burning also stimulates growth of desirable plants, provides some fertilizer, destroys the hiding places of some predators, and affords good cattle grazing during the winter months. (See also W72-10040) (Settle-Wisconsin)

THE COASTAL INTERFACE,

Bureau of Commercial Fisheries Galveston, Tex. Biological Lab.

R. J. Hoogland.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ Sea Grant Program, September, 1970, p. 76-81.

Descriptors: \*Estuaries, \*Estuarine environment, \*Urbanization, Environmental effects, Cost-benefit analysis, Intangible costs, Intangible

The coastal interface, and particularly the estua-ries, are very important elements in the life cycle of many commercially important species. Estua-ries usually have a well-defined salinity gradient between the river and the sea. Consequently, they

# WATER QUANTITY MANAGEMENT AND CONTROL-Field 04 Effects on Water of Man's Non-Water Activities—Group 4C

are normally characterized by a broad spectrum of conditions throughout which many species can be accommodated simultaneously. Although marine species have adapted their life cycles to take advantage of these special conditions, this specialization leads to success for the species only as long as no major changes in their living areas occasions. long as no major changes in their living areas occur. Such major changes are being wrought by the
continuing economic and population growth along
Texas' Gulf Coast. Specific activities which pose a
threat to the coastal environment include bulkheading and filling; dredging of channels and fossil
shell deposits; stream diversions; and restriction
of tidal exchange and fresh-water runoff. Many of
these activities are undertaken because development accounting has determined that benefits exced costs. However, such accounting usually excludes the costs of degrading the environment or
the benefits of leaving the environment alone. (See
also W72-10040) (Settle-Wisconsin)
W72-10052

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HYDROMETEOROLOGY FOR URBAN RU-NOFF SYSTEMS, Texas A and M Univ., College Station. Dept. of Meteorology. For primary bibliographic entry see Field 06A. W72-10104

LEGISLATIVE ROUTE 11084, SECTION 3, CAMBRIA COUNTY, PENNSYVANIA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Pennsylvania Dept. of Transportation, Harrisburg. For primary bibliographic entry see Field 06E. W72-10185

#### URBAN HYDROLOGY.

Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, 1970. 287 p.

Descriptors: \*Urban hydrology, \*Conferences, \*Water pollution sources, \*Storm runoff, \*Urban runoff, Model studies, Rainfall-runoff relationships, Storm water, Urban drainage.

Problems associated with runoff in urban areas Problems associated with runoff in urban areas derive not only from the necessity to handle runoff that enters the area from natural watersheds, but also from the necessity to evaluate the effects of urbanization on the actual runoff process. In general, the creation of impervious sections of the drainage area causes an increase in the total volume of runoff and in the peak rates of runoff. Furthermore, the drainage of natural ponding areas, the improvement of natural channels and the realignment of drainage patterns can greatly increase the peak rates of runoff. Runoff from urban areas has increasingly become a quality ropolem in crease the peak rates of runoff. Runoff from urban areas has increasingly become a quality problem in the receiving rivers. When rainfall washes the cities and surrounding areas, the resulting runoff can contribute to river pollution. Many cities have combined sewers, and overflows often contribute seriously to river pollution. (See also W72-10285 thru W72-10297) (Knapp-USGS)

EFFECT OF URBAN EXPANSION ON HYDROLOGIC INVESTIGATIONS, Corps of Engineers, Waltham, Mass. New England Div. E. F. Childs.

In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 1, 1970. 22 p, 6 plate,

Descriptors: \*Urban hydrology, \*Massachusetts, \*Urban runoff, \*Floods, \*Flood control, Rational formula, Storm runoff, Storm water, Rainfall-runoff relationships, Urban drainage. Identifiers: \*Quincy (Mass).

A simple, straightforward procedure was used recently for studying the hydrology of a brook undergoing rapid changes in urban expansion. The method is acceptable for reconnaissance reports. In an example for Town Brook, Quincy, Massachusetts, the hydrologic relationships are empirical as there are no stream gaging stations in the watershed. The rational formula was used to compute discharges for different dates of analysis. Urban conditions are projected to the year 2000. (See W72-10284) (Knapp-USGS)

EFFECTS OF URBAN DEVELOPMENT ON STORM RUNOFF RATES,
Army Engineer District, Galveston, Tex.

Army Engineer District, Gardenson, 12-6.
G. S. Hare.
In: Proceedings of Seminar on Urban Hydrology,
Davis, California, September 1-3, 1970: Army
Corps of Engineers Hydrologic Engineering
Center Publication, Paper No 2, 1970. 34 p. 17 fig.

Descriptors: \*Urban hydrology, \*Storm runoff, \*Unit hydrographs, \*Urban runoff, Rational for-mula, Rainfall-runoff relationships, Storm water,

Some of the developments in urban hydrology over the past 60 or 70 years are reviewed briefly, and some recent developments in the study of urban hydrology are described in more detail, as they are applied to the design of such facilities as hurricane protection projects, flood control channels, stream rectification works, and flood plain management or control activities in urban areas. While it is not difficult to determine that urban development generally increases both the total rudevelopment generally increases both the total ru-noff and the peak runoff rates, it has been ex-tremely difficult to develop relationships which accurately define the extent of these changes. The Corps of Engineers has used the basic unit hydrograph method extensively in development of hydrology for its civil works projects. Results ob-tained by this method are reliable and acceptable when proper coefficients are used. (See W72-10284) (Knapp-USGS) W72-10286

EFFECTS OF URBANIZATION ON ANNUAL PEAK FLOW FREQUENCY ANALYSIS, Army Engineer District, Baltimore, Md. D.L. Robey.
In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 3, 1970. 14 p, 10 ref.

Descriptors: \*Urban hydrology, \*Storm runoff, \*Virginia, \*Urban runoff, \*Flood frequency, Statistics, Rainfall-runoff relationships, Floods, Frequency analysis, Peak discharge, Urbaniza-

Identifiers: Fourmile Run (Va).

Urban hydrology is the newest and possibly the most rapidly changing field of hydrology. It was originally just concerned with the downtown paved area; this is not sufficient today because of urban sprawl. The frequency of flooding is a necessary consideration in planning land use and development. Belditarships for the strength of t necessary consideration in planning land use and development. Relationships for estimating the magnitude and frequency of occurrence of flood peaks on a drainage basin having a high degree of urban and suburban development are reviewed. The basin used in this study is Fourmile Run located in northern Virginia. The drainage area is 14.4 square miles, and the channel capacity is approximately 2,700 cfs. In recent years the area has undersone considerable development and proximately 2,700 cfs. In recent years the area has undergone considerable development and redevelopment. Flood conditions are produced by intense rainfall of short duration. Lag time, the parameter most affected by urbanization, is, for a completely storm-sewered system, about oneighth that of a comparable natural system. On small, steep basins, drainage improvements alone may triple average flood sizes, and complete development of stream channels and the basin surface may increase average floods by a factor of 8. A complete impervious surface will increase the average size flood by a factor of 2-1/2, but decreases larger floods. There is a large variability in results when different methods are used to in results when different methods are used to define the peak flow-frequency relationship. For the 100-year flood the discharge estimates ranged from 12,740 to 29,600 cfs. Based upon recommendations by the Water Resources Council, the use of the log-Pearson Type III distribution, modified to include the recent U.S.G.S. study to define the mean annual flood, seems desirable. (See W72-10284) (Knapp-USGS) W72-10287

A UNIFIED METHOD FOR COMPUTING PEAK DISCHARGE FROM UNGAGED URBAN AREAS FOR CORPS OF ENGINEERS STUDIES, Army Engineer District, Little Rock, Ark. W. R. Henson.
In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 4, 1970. 15 p, 2 fig, 12 ref.

Descriptors: \*Urban hydrology, \*Unit hydro-graphs, \*Rainfall-runoff relationships, \*Storm ru-noff, \*Urban runoff, Model studies, Storm water, Floods, Peak discharge, Urbanization, Stream gages, Simulation analysis, Flood frequency, Depth-area-duration analysis, Identifiers: \*U.S. Army Corps of Engineers.

In urban hydrology, development cost, ease of use, and general applicability are the three most important characteristics that should be considered in selecting one of the methods for use in computing peak discharges from ungaged areas. The use of comprehensive digital simulation The use of comprehensive digital simulation models in the immediate future will probably be limited to research in the major universities because of the computer capability required. The simulation model may prove economical where a long period of record is required for design of an urban flood control project in an extremely high-damage potential area. It is hard to visualize the use of the model in a flood plain information study with a total budget of \$25,000. Synthetic unit hydrographs appear to be the method most adaptable for use in Corps of Engineers studies. If a sampling of basic data can be provided from urban centers over the country, the resulting method will probably have general applicability. To develop a generalized method for determining the unit hydrograph peaks for ungaged urban areas would hydrograph peaks for ungaged urban areas would require a competent staff, time, and sufficient funds to compile the unit hydrographs, basin characteristics, degree of urban development, and the relating functions. In urban areas void of gaging stations, new stations would have to be set up. Although development of a method of this type would involve a large initial investment, this would be offset by the ease of use and no recurring cost. (See W72-10284) (Knapp-USGS) W72-10288

TULSA DISTRICT METHOD OF URBAN HYDROLOGY,

Army Engineer District, Tulsa, Okla. S. E. Jones.

S. E. Joues.
In: Proceedings of Seminar on Urban Hydrology,
Davis, California, September 1-3, 1970: Army
Corps of Engineers Hydrologic Engineering
Center Publication, Paper No 5, 1970. 13 p., 2 fig, 1

Descriptors: \*Urban hydrology, \*Unit hydro-graphs, \*Rainfall-runoff relationships, \*Storm ru-noff, \*Urban runoff, Storm water, Floods, Peak discharge, Urbanization, Stream gages, Simula-tion analysis, Flood frequency, Depth-area-dura-tion analysis. tion analysis. Identifiers: \*Tulsa (Okla).

In recent years the increase in urban development has been tremendous. This urban growth replaces forests and fields with the paved areas and struc-

#### Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

#### Group 4C-Effects on Water of Man's Non-Water Activities

tures of residential, commercial, and industrial development. Under these circumstances the design of flood control projects by the Corps of eers must take into account the effects of this urban development on storm runoff rates. This is particularly true when Flood Plain Information and Local Protection Studies are requested for small drainage areas which are or will be largely overbuilt by urban development. The method used by the Tulsa District Corps of Engineers to determine the effects urbanization has on small areas, with respect to surface runoff is presented. Where recorded hydrographs are not available to permit derivation of unit hydrographs, the synthetic unit hydrograph is usually selected. (See W72-10284) (Knapp-USGS) W72-10289

SYNTHETIC UNIT HYDROGRAPH RELATION-SHIPS, TRINITY RIVER TRIBUTARIES, FORT WORTH-DALLAS URBAN AREA,

Army Engineer District, Fort Worth, Tex.

In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 6, 1970. 18 p, 5 fig, 3

Descriptors: \*Urban hydrology, \*Unit hydro-graphs, \*Rainfall-runoff relationships, \*Storm rugraphs, \*Rainfall-runoff relationships, \*Storm ru-noff, \*Urban runoff, Storm water, Floods, Peak discharge, Urbanization, Stream gages, Simulation analysis, Flood frequency, Depth-area-duration analysis.

Identifiers: \*Dallas (Tex), \*Fort Worth (Tex).

Fort Worth and Dallas, Texas are a rapidly expanding urban area. Although much of the growth has been orderly and well planned, development in many flood-prone areas has resulted in severe damages and in the necessity for the construction of local or Federal flood control works. Relationships are presented to be used to develop synthetic unit hydrographs for ungaged areas in the Fort Worth-Dallas area. The method accounts for differences in urban development on adjacent areas and may be used to predict the effect that urban development might have on a given area. Preliminary calculations indicate that the lag relationship may also be valid in other parts of northcentral Texas. Unit hydrograph determinations were made for each of eight stream gages for each storm period which could be analyzed. In order to generalize the results of these studies for use in ungaged areas, the coefficients were correlated measurable watershed characteristics. Since in the Fort Worth-Dallas area full urbanization of an entirely rural area reduces the lag time by about , the peak discharge of the unit hydrograph will be approximately doubled. (See W72-10284) (Knapp-USGS) W72-10290

DISCUSSION OF SOME ASPECTS OF URBAN HYDROLOGY METHODOLOGY,

Corps of Engineers, Omaha, Nebr. Missouri River Div.

C. W. Timberman.

In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 7, 1970. 48 p, 24 fig, Engineering

Descriptors: \*Urban hydrology, \*Unit hydrographs, \*Rainfall-runoff relationships, \*Storm runoff, \*Urban runoff, Model studies, Storm water, Floods, Peak discharge, Urbanization, Stream gages, Simulation analysis, Flood frequency, Depth-area-duration analysis.

The distinctive hydrologic characteristic of urban hydrology is the change in runoff response of an area as a function of its development. The unit hydrograph mathematical modeling procedure appears to be a suitable method of analyzing urban area runoff. The unit hydrograph characteristics including time to peak, peak discharge, and recession factor can be correlated to physical basin characteristics such as slope, basin shape, basin storage, and channel and overland flow efficiency. Loss rates, or runoff factors, can be determined with sufficient accuracy and properly related to rainfall duration, season, API, and rainfall intensi-ty. The recommended methodology can be related to a specific design criteria, is based on established hydrologic concepts, is relatively easy to apply, provides a basis for evaluating basin storage ef-fects, and allows determination of an optimum design discharge and volume for selected design criteria. (See W72-10284) (Knapp-USGS)

URBAN HYDROLOGY IN CONNECTION WITH CHANNEL IMPROVEMENT PROJECT AT NEWMARKET CREEK, VIRGINIA, Army Engineer District, Norfolk, Va.

In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 8, 1970. 17 p, 8 fig. 4

Descriptors: \*Urban hydrology, \*Unit hydro-graphs, \*Rainfall-runoff relationships, \*Storm ru-noff, \*Urban runoff, Storm water, Floods, Peak discharge, Urbanization, Stream gages, Flood frequency, Depth-area-duration analysis. Identifiers: \*Newmarket Creek (Va).

Flood frequencies were determined for a proposed channel improvement in Newmarket Creek, Va. The drainage area contributing to the channel ranged from 2.33 square miles to 8.54 square miles various conditions of watershed development and various portions of channel improved. A large shopping center, similar to the thousands of such centers being constructed throughout the country, was constructed directly on the flood plain. A channel, which proved to be inadequate, was provided around the end of the shopping center to carry the flow of the stream. Slopes in the main study area are relatively flat, about 0.5 feet per 1000 feet. Also, the cross section of the flood plain on either side is flat so that, under natural conditions, considerable water is stored along the stream and runoff is slow. Unit hydrographs were derived for a drainage area of one square mile for a number of different times of concentration covering the required range expected in the study. The 10-, and 100-year peak flood discharges were obtained by application of appropriate storm rainfall to the unit hydrographs. (See W72-10284) (Knapp-USGS) W72-10292

A MATHEMATICAL DETERMINATION OF THE ORDINATES OF THE UNIT HYDRO-

Army Engineer District, Albuquerque, N. Mex. J. A. Constant.

In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 9, 1970. 12 p, 5 fig, 1

Descriptors: \*Urban hydrology, \*Unit hydro-graphs, \*Rainfall-runoff relationships, \*Storm ru-noff, \*Urban runoff, Storm water, Floods, Peak discharge, Urbanization, Stream gages, Flood frequency, Depth-area-duration analysis. Identifiers: \*U.S. Army Corps of Engineers.

An equation is given for the unit hydrograph, and a means of evaluating the parameters in terms of the time and magnitude of the unit hydrograph peak and the contributing area is presented. The method is easily programmed for use in an electronic comprogram, such as one for determining basin runoff during flood periods. (See W72-10284) (Knapp-USGS) W72-10293

AN ANALYSIS OF THE EFFECTS OF UR-BANIZATION ON UNIT HYDROGRAPH CHARACTERISTICS, ANTELOPE CREEK BASIN-LINCOLN, NEBRASKA, Army Engineer District, Omaha, Nebr. K. A. Johnson.

In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 10, 1970. 19 p, 8 plate, 4 tab.

Descriptors: \*Urban hydrology, \*Unit hydrographs, \*Rainfall-runoff relationships, \*Storm ru-noff, \*Urban runoff, Storm water, Floods, Peak discharge, Urbanization, Stream gages, Flood frequency, Depth-area-duration analysis.

Identifiers: \*Antelope Creek (Nebr), Lincoln

Hydrologic design requirements and hydrologic effects of a small dam were calculated in the Antelope Creek basin, Lincoln, Nebraska. The proposed dam was located in the upper portion of the basin to control runoff from a 5.4-square-mile rural area. City Planners forecast that the area above the dam would become a fully developed urban area. The results of this study were used in evaluating future flood probability conditions in the basin under the anticipated urban development with and without the dam in place. Unit graph characteristics were determined for the urban and rural portions of the basin. For the Antelope Creek Area, the use of the generalized equations resulted in an increase in unit hydrograph peak discharge of 80% in going from a rural area to one of 60% impervious and fully sewered. The most important factor in determining the effects of urbanization on peak discharges is an estimate of the storm sewer and channel improvement factor. (See W72-10284) (Knapp-USGS) W72-10294

HYDROLOGY CONSIDERATION. URBAN STATE OF HAWAII,

Corps of Engineers, Honolulu, Hawaii.

J. B. Clark.

In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 11, 1970. 9 p, 1 fig, 3

Descriptors: \*Urban hydrology, \*Unit hydropescriptors: "Oroan nydrology, "Only nydro-graphs, "Rainfall-runoff relationships, "Storm ru-noff, "Urban runoff, Storm water, Floods, Peak discharge, Urbanization, Stream gages, Flood frequency, Depth-area-duration analysis. Identifiers: "Honolulu (Hawaii).

Kuliouou Valley is on the southeastern corner of the island of Oahu, about 10 miles southeast of Honolulu, on the leeward side of the Koolau Mountains. The population of Kuliouou Valley has increased from 800 in 1950 to 1,700 in 1963. The flood plain is presently fully developed. On islands as Oahu, where mountain peaks do not exceed 5,000 feet, maximum annual rainfall accumulations occur along the ridge lines and decrease with elevation on both the leeward and windward sides. Intensities during storms also follow this pattern but not as pronouncedly as the annual accumulations. The increased runoff and shorter concentration times in the urban area are offset by a lesser rainfall depth-duration relationship in the lower elevation. Unit hydrographs for the project area were developed synthetically, utilizing mountain lag curves transferred to the Hawaiian Islands on the basis of rainfall and runoff studies. Runoff volume from the 50-year and 100-year floods was computed to be 1, 8, and 2.5 inches, respectively. (See W72-10284) (Knapp-USGS)

KANSAS CITY DISTRICT EXPERIENCES IN URBAN HYDROLOGY, Army Engineer District, Kansas City, Mo. W. L. Northrop.

In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 12, 1970. 25 p, 9 fig,

Descriptors: \*Urban hydrology, \*Unit hydro-graphs, \*Rainfall-runoff relationships, \*Storm ru-noff, \*Urban runoff, Storm water, Floods, Peak discharge, Urbanization, Stream gages, Flood frequency, Depth-area-duration analysis. Identifiers: \*Kansas City (Mo).

Detailed hydrologic criteria were developed for betailed hydrologic criteria were everloped for ten small basias near Kansas City with very limited gaging records. These criteria have been used for flood plain reports, technical service type information to local agencies, and survey type studies for flood control measures. The effects of existing and projected urbanization are factors in a majority of these projects. Discharge-frequency curves and standard project flood peaks were established for natural conditions, existing development, and proposed improvements in the drainage system. With some modification of the subareas and unit hydrograph previously used for the standard project flood determinations, satisfactory 100-year hydrographs for all inflow points and tributary contributions were developed. Routing studies were made using approximately 'road culvert' configuration as outlets and with assumed broadcrested overflow weirs at the 100-year pool elevation. A relatively small amount of storage has a large reducing effect on the peak discharges. The effect would be proportionately much less on the larger standard project flood peak discharges. (See W72-10284) (Knapp-USGS) W72-10296

URBAN HYDROLOGY CONSIDERATIONS IN THE DESIGN OF INTERIOR DRAINAGE FACILITIES FOR LOCAL FLOOD PROTEC-TION PROJECTS, Ohio River Div. Labs., Mariemont.

A. G. Holler.

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In: Proceedings of Seminar on Urban Hydrology, Davis, California, September 1-3, 1970: Army Corps of Engineers Hydrologic Engineering Center Publication, Paper No 13, 1970. 23 p, 4 fig,

Descriptors: \*Urban hydrology, \*Rational formula, \*Rainfall-runoff relationships, \*Storm runoff, \*Urban drainage, Urban runoff, Storm water, Peak discharge, Urbanization, Depth-area-dura-

Identifiers: Dayton (Ky), Middlesboro (Ky).

Usually drainage facilities whose capacities have been determined by an application of the rational method will be required to function over a suffi-ciently long period of time during which it can be reasonably assumed that runoff relations will be altered somewhat. The runoff coefficient selected must reflect in some way future conditions expected in the drainage area that would affect peak runoff. The future expected peak runoff can then be compared to the design capacity of the drainage facilities to determine their adequacy. Evidence has been presented in the literature to propose the hypothesis that hydrologically significant im-permeable area is related to population density. Based on a brief study of two local flood protection projects it appears that selected runoff coefficients are sufficiently conservative to allow for some degree of future urbanization without signifi-cantly altering the degree of protection provided by the projects. However, more accurate methods of determining runoff coefficients may result in reduced conduit and pump capacities that could reduce the cost of a project. (See W72-10284) (Knapp-USGS) W72-10297

HYDROLOGIC AND DISPOSAL PROBLEMS IN URBAN AREAS, Stanford Univ., Calif., Dept. of Geology.

I. Remson.

I. Remson.

In: Environmental Planning and Geology, Proc of Symposium on Engineering Geology in the Urban Environment, Oct 1969, San Francisco, Calif: Geological Survey, Dept. of the Interior, and Office of Research and Technology, Dept. of Housing and Urban Development Cooperative Report, p36-41, December 1971. 3 fig, 3 photo, 1 tab, 7 ref.

Descriptors: \*Urban hydrology, \*Water management (Applied), \*Urbanization, Water quality control, Water supply, Water treatment, Sewage treatment, Waste disposal, Planning, City planning, Land use, Suburban areas.

An important objective of regional planning is to minimize damage stemming from urbanization. Some of the hydrologic problems of urbanization are illustrated by preliminary hydrologic analysis and design for the watershed of the Upper East Branch of the Brandywine Creek in Chester Coun-Branch of the Brancywine Creek in Chester Country, Pa. A plan was prepared for the orderly development of this basin. The stated objectivewas to plan the urban development with the minimum of damage and disruption to the water, scenic, and other natural resources. The average annual surplus of precipitation in excess of evapotranspiration is 16.7 inches. Although large volumes of water would move through the local hydrologic system, the natural capacities to pro-vide a source of potable water and to absorb wastes would be exceeded for the design population, despite the favorable hydrologic charac-teristics. Furthermore, a completely acceptable hydrologic environment could not be engineered nyarologic environment could not be engineered for the design population, using currently available technology, at an acceptable cost. This led to the development of a philosophical approach to hydrologic design for urbanization. It might be possible to go beyond the confines of the developed watershed for water supply and waste disposal, to restrict the density of development, or to engineer the watershed more intensively. For example, the eutrophication problem could be solved by a chemical precipitation facility. Howsolved by a chemical precipitation facility. How-ever, every increase in technology involves costs that increase nonlinearly with population. It is the role of the hydrologist to provide the urban developer with basic data and hydrologic predic-tions upon which management decisions can be based. Hydrologists find hydrologic models useful for this prediction and extrapolation. (Knapp-IISGS) USGS) W72-10327

STORM WATER RUNOFF FROM AN URBAN

HIGHWAY DRAINAGE SYSTEM,
District of Columbia Dept. of Highways and Traffic, Washington. Materials Development and Research Div.

K. Morrision, J. B. Kim, F. W. Ellerman, J. I.

K. MOTISION, J. B. Klim, F. W. Ellerman, J. I. Chang, and H. H. Liu.
Available from NTIS, Springfield, Va. 22151 as PB-207 275, \$3.00 in paper copy, \$0.95 in microfiche. Final Research Report, August 25, 1971. 123 p, 92 fig, 9 tab, 20 ref. Project No. HPR-1 (7) 615

Descriptors: \*Rational formula, \*Rainfall-runoff relationships, \*Urban runoff, \*Urban hydrology, \*District of Celumbia, Urban drainage, Storm drains, Storm runoff, Urbanization, Cities, Unit hydrographs, Depth-area-duration analysis, Peak discharge, Runoff coefficient, Time of concentra-

A modified area-time method was developed for calculating the rates of runoff in urban highway calculating the rates of runoff in uroan nignway drainage systems and is compared with existing methods. A drainage area of approximately 10 acres in Washington, D.C. was chosen, and rainfall and runoff from the area were measured. Although the peak runoff rates computed by the modified area-time method and the unit hydro-graph method did not compare favorably with the peak runoff rates that were actually measured, the

peak rates computed by an empirical version of the rational method did give a reasonable estimate of the actual runoff rate. The design values (the runoff coefficient and the time of concentration) that are used in the rational method were determined from recorded data. This version of the rational method produced good results. When an accurate method is found for determining the runoff coeffimethod is sound for determining the runoff coeffi-cient and time of concentration, the rational method will provide a simple, economical, and re-liable tool that can be used in designing urban highway drainage facilities. (Knapp-USGS) W72-10342

ECONOMICS OF WATER QUALITY AND WASTEWATER CONTROL, California Univ., Los Angeles. Graduate School of

Management. For primary bibliographic entry see Field 05G. W72-10426

## 4D. Watershed Protection

METHOD AND APPARATUS FOR PREVENT-ING EROSION,

Gray Tech Industries, Inc., Mohnton, Pa. C. W. Strickler, Jr.

U. S. Patent No. 3,653,216, 3 p, 2 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 897, No. 1, p. 45, April 4, 1972.

Descriptors: "Patents, "Erosion, "Beach erosion, "Waves (Water), Shore protection, Coastal engineering, "Breakwaters, Beaches, Ocean waves, Tidal waters, Structures.

Hollow enclosures, such as 'quonset' type hunts, are placed end-to-end along the beach. Slots are made on the walls of the hut. Incoming and outgo-ing waves will be retarded in volocity by flowing through the slots. Reduction of wave velocity will cause deposition of sand as waves ride over the hut. (Sinha-OEIS) W72-09795

California Univ., Riverside. Dept. of Soils and Plant Nutrition.

California Agriculture, p 12-13, June 1970. 2 fig.

Descriptors: \*Surfactants, \*Soil chemical proper-ties, \*Wettability, \*Erosion control, Infiltration rates, Runoff, Soil stabilization, Laboratory tests, Surface tension, Land management, California. Identifiers: \*Water-repellent soils, Burned watersheds.

This report gives the results of a study to determine the effect of wetting agents to reduce erosion in southern California. Water-repellent soils have two undesirable physical properties: low rate of water infiltration, and high runoff. Many parts of the world have such soils, but in California burned watersheds create real practical problems of ex-treme erosion. Two nonionic surfactants were used at four rates of application which are described. A graph presents curves representing surface tension of the two products as a function of the concentration. Aqua Gro reduced surface tension more than Soil Penetrant at low concentrations, but the reverse is true at higher concentrations. Laboratory procedures are described for the experiments conducted under various conditions. (Lang-USGS)
W72-09872

DUST ABATEMENT AT CANYON FERRY LAKE, CANYON FERRY UNIT, HELENA-GREAT FALLS DIVISION, PICK-SLOAN MISSOURI BASIN PROGRAM MONTANA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Bureau of Reclamation, Washington, D.C. For primary bibliographic entry see Field 06E. W72-10174

# Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

# Group 4D—Watershed Protection.

EAST FORK OF WHITEWATER RIVER WATERSHED, INDIANA AND OHIO (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 06E.

CACHE RIVER BASIN PROJECT, ARKANSAS (DRAFT ENVIRONMENTAL IMPACT STATE-

Army Engineer District, Memphis, Tenn. For primary bibliographic entry see Field 06E. W72-10192

THE PERMISSIBLE EXTENT OF RIPARIAN

For primary bibliographic entry see Field 06E. W72-10195

#### 05. WATER OUALITY MANAGEMENT AND PROTECTION

#### 5A. Identification of Pollutants

APPARATUS FOR DETECTING THE HARD-

NESS LEVEL OF WATER, Eric Manufacturing Co., Milwaukee, Wis. (As-

signee). R. K. Engholdt.

U. S. Patent No. 3,652,861, 3 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 4, p. 1511, March 28, 1972.

Descriptors: \*Patents, \*Hardness, \*Water properties, \*Water softening, Water quality, Equipment.

The detection equipment consists of a pair of photo-conductive cells, a light source and a filter element. One of the cells is positioned to receive light which has passed through the sample, the other is positioned to receive light which has passed through a filter element corresponding in color to a sample which is below a predetermined hardness level. The sample is mixed with a reagent which is formulated to cause it to change color at a predetermined hardness level. When it is above the preselected hardness it will be colored different from that of the filter element. When the color and intensity of the light falling on the two cells are different the bridge circuit will become unbalanced. The resulting signal can initiate the regeneration cycle of a water softener apparatus. (Sinha-OEIS) W72-09801

SITU FLUOROMETER USING

SYNCHRONOUS DETECTOR, Prototypes, Inc., Kensington, Md.; and Zone Research, Inc., Washington, D. C. W. B. Leaf.

U. S. Patent No. 3,649,833, 4 p, 4 fig, 1 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 2, p. 783, March 14, 1972.

Descriptors: \*Patents. Instrumentation. Pseupons. Fluorescence, Pollution, Fluorescence, Pollutant identification, Analytical techniques. Identifiers: \*Fluorometers.

The self-contained submersible fluorometer uses the double beam optical bridge principle to measure very low fluorescent levels. A light chopper permits a photodetector to look alternately at the emission from the fluorescing sample and a reference light in a standard balancing path of the bridge. The reference light is adjusted by a servo driven, circular neutral density wedge filter which has a continuous transmissibility variation of several decades of light. (Sinha-OEIS) W72-09816

DETERMINATION ABSOLUTE RADIONUCLIDES IN WATER BY GAMMA RAY SPECTROMETRY, (IN GERMAN), H. Mundschenk.

Dtsch Gewaesserk Mitt. Vol 15, No 4, p 95-105.

1971. Illus. English summary.
Identifiers: \*Determination, Gamma-Ray, Germany, \*Radionuclides, Spectrometry.

Absolute counting of radionuclides in river water can be effected by using a calibrated scintillation detector. The determination of single radionuclides is performed without any chemical separation. The sensitivity of this method is far beyond the critical values listed in the 'Strahlenschutzverordnung' (Radiation safety ordinance) of the Federal Republic of Germany. Decomposition of overlapping photopeaks is achieved by means of suitable methods described in detail.--Copyright 1972, Biological Abstracts, W72-09832

AND PHYSICAL CHARAC-CHEMICAL TERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1968-SEPTEMBER 1969. Geological Survey, Austin, Tex.

For primary bibliographic entry see Field 02L. W72-09855

THE DISTRIBUTION OF MERCURY IN THE

DEPARTMENTS OF LAKE ONTARIO,
Department of Energy, Mines and Resources,
Burlington (Ontario). Canada Centre for Inland

For primary bibliographic entry see Field 05B. W72-09859

ON CS-134 IN RAINWATER FROM 1968 TO

1969. Comitato Nazionale per L'Energia Nucleare, Casaccia (Italy). laboratorio Radioattivita Ambien-

For primary bibliographic entry see Field 05B. W72-09873

FLUOROMETRIC DETERMINATION OF CHLOROPHYLL A IN THE PRESENCE OF PHEOPIGMENTS: EFFECT OF THE HALF-VALUE WIDTH OF THE EXCITATION BEAM, European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center. M. F. Baudouin, and P. Scoppa.

Mar Biol. Vol 10, No 1, p 66-69, 1971. Illus. Identifiers: Acidification, "Chlorophyll, Determination, Ecology, "Excitation, Fluorometry, "Pheopigments, "Analytical techniques.

The ratio of fluorescence intensities chlorophyll a before and after acidification is dependent upon the excitation wavelength and upon the spectral band width of the excitation beam. Optimal conditions for differentiating between chlorophyll a and pheopigments occur when the excitation wavelength is in the range of 435 to 440 nm and the half-value width of the beam is less than 6 nm. The reduced sensitivity brought about by the low amount of energy reaching the sample under these conditions can be compensated for by minor modification of other instrumental parameters.--Copyright 1972, Biological Abstracts, Inc. W72-09925

DETERMINATION OF DISSOLVED OXYGEN AND NITROGEN IN WATER USING GAS CHROMATOGRAPHY, (IN GERMAN),

Schweizerische Unfallversicherungsanstalt, Lu-cerne. Abteiling Unfallverhuetung.

Schweiz Z Hydrol. Vol 33 No 1 p 117-120. 1971. (English summary).

Identifiers: \*Gas chromatography, \*Dissolved oxygen, \*Nitrogen, \*Analytical techniques.

A method is proposed for the concomitant determination of N and O2 dissolved in water. After sampling in glass flasks, the water is displaced par-tially by He N and O2 dissolved in water, is then transferred into He, in which the 2 gases are determined by gas chromatography. The results ob-tained are compared with those received by the Winkler method for determination of O2.--Copy-right 1972, Biological Abstracts, Inc. W72-09929

IDENTIFICATION OF CARBONYL COM-POUNDS IN A SWINE-BUILDING AT-

L. D. Hartung, E. G. Hammond, and J. R. Miner. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 105-106. 1 tab, 10 ref.

Descriptors: \*Farm wastes, Atmosphere, Odor, Swine, Organic compounds, Air pollution, Land management.

Identifiers: Carbonyl-free air, Sutton's equation, Carbonyls.

Prior studies of swine-building atmospheres have identified amines, carbonyls and sulfur compounds in these gases. More detailed identification work is being done to determine which compounds of these three classes are responsible for odor. This information should be valuable for eventual odor-control technology. Carbonyls can be deter-mined readily as the 2,4-dinitrophenyl-hydrazine (2,4-DNPH) derivatives. A measured quantity of swine-house gas was pulled through a reaction column composed of a solution of 2,4-DNPH (in 2.5M H2SO4) on celite. The 2,4-DNPH derivatives were eluted from the column with hexane at the end of the run. Tentative identification was by thin layer chromatography (tlc), which allowed quantitative measurement of those compounds present in largest concentrations. In these cases, the derivative was leached from the tlc material, diluted to a measured volume, and the ultraviolet absorption max was measured. Carbonyls absorption max was measured. Caroonyis identified to date and their concentrations when measurable are: acetone (125 ppb by volume), ethanal, butanal, methyl ethyl ketone (53 ppb), pentanal, nonanal. (See also W72-09940) (Bundylowa State) W72-09968

CHROMATOGRAPHIC IDENTIFICATION OF MALODODORS FROM DAIRY ANIMAL

Ohio State Univ., Dept. of Agricultural Engineering. Columbus.

R. K. White, E. P. Taiganides, and G. D. Cole. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 110-113, 5 fig, 2 tab, 8 ref.

Descriptors: \*Farm wastes, \*Chromatography, Analytical techniques, Odor, Hydrogen ion con-centration, Aeration, Sulfur, Organic compounds,

Identifiers: \*Anaerobic dairy wastes.

Recent trends toward large, confined animal production units and the urban encroachment into agricultural areas have brought into focus the agricultural areas have orongin into tocus the problem of odor nuisance from animal waste. There is a need for identifying satisfactory methods of controlling and abating the odor nuisance from animal waste. Before control techniques can be developed, an analysis of the odors and an understanding of the physical, chemical and biological conditions that help generate them is needed. The objectives of this study were: to separate and identify principal odorous compounds emanating from dairy animal wastes and to measure the effect of aeration on the production of principal odors from dairy animal wastes. Eight odorous compounds were tentative-

ly identified by comparing Kovat Indexes for the principal odorous fractions separated by the gas chromatograph and the Kovat Indexes of known chromatograph and the Kovat Indexes of known compounds. Also, an organoleptic evaluation of the odors was employed. The compounds tentatively identified using the column selected for hydrocarbons and sulfur compounds were hydrogen sulfide, methanethiol, methyl sulfide, diethyl sulfide, propyl acetate and n-butyl acetate. The amine compounds detected were trimethylamine and ethylamine. Aeration eliminated or diminished the production of the principal odors identified. (See also W72-09940) (Bundy-lowa State) W72-09970

QUALITY OF EFFLUENT FROM FARM ANIMAL PRODUCTION SITES, Louisiana Tech Univ., Ruston. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W72-09985

BOD ANALYSIS OF SWINE WASTE AS AF-POP ANALISIS OF SWINE WASTE AS AF-FECTED BY FEED ADDITIVES, North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering. For primary bibliographic entry see Field 05C. W72-09989

SURVIVAL AND DETECTION OF LEP-TOSPIRES IN AERATED BEEF CATTLE Minnesota Univ., St. Paul. Dept. of Agricultural Engineering.
S. L. Diesch, B. S. Pomeroy, and E. R. Allred.
In: Livestock Waste Management and Pollution
Abatement, Proceedings International Symposium
on Livestock Wastes, Ohio State University, April
19-22, 1971, p 263-266, 2 fig, 1 tab, 16 ref.

Descriptors: \*Pathogenic bacteria, \*Farm wastes, \*Aeration, Cattle, Aerobic conditions, Waste storage, Pollutant identification, Oxidation lagoons, Public health.

Identifiers: Leptospira pomona.

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Leptospira pomona, a pathogen capable of infecting both man and animals, was studied in an extended aeration method of animal manure treatment. A laboratory oxidation ditch model was developed for studying leptospires at simulated winter environmental conditions. A fluorescent antibody technique was developed and utilized for detection of leptospires. Findings indicate that pathogenic leptospires are capable of survival for up to 18 days in an aerated model oxidation ditch and 11 days in effluent and sludge. These findings do not determine the ability of leptospires isolated from a manure environment to establish infection of man and animals. There must be public concern for potential contamination of the environment and the development of health hazards because shedding of leptospires may occur for long periods of time in infected cattle. The disease is of major of time in infected cattle. The disease is of major economic and public health importance and widespread in animal reservoirs. Treatment of sludge and effluents by chlorination or other methods is needed before discharge. (See also W72-09940) (Schmitt-Iowa State)

CLEANUP PROCEDURE FOR WATER, SOIL, ANIMAL AND PLANT EXTRACTS FOR THE USE OF ELECTRON-CAPTURE DETECTOR IN THE GAS CHROMATOGRAPHIC ANALYSIS OF ORGANOPHOSPHOROUS INSECTICIDE RESIDUES, Kansas State Univ., Manhattan. Dept. of En-

Bulletin of Environmental Contamination and Toxicology, Vol. 3, No. 4, p 247-253, 1968. 1 tab, 10 ref. OWRR B-007-KAN (3).

Descriptors: \*Analytical techniques, \*Gas chromatography, \*Pesticide residues, Chromatography, Organophosphorous pesticides, Diazinon. Identifiers: Parathion, Methyl parathion, Malathion, Thimet, Pesticide residue analysis.

Conventional partitioning methods have been demonstrated as efficient and useful, but they demonstrated as efficient and useful, but they cause interference in operating the electron capture detector in gas chromatography. A simple, aqueous acetonitrile partition cleanup method for analyses of some common organophosphorous insecticide residues is described. The procedure is for cleanup and quantitative recovery of parathion, methyl parathion, diazinon, malathion and thimet from different extracts. Those insecticies in the purified extracts of ground water and thimet from different extracts. Those insecticides in the purified extracts of ground water, grain, soil, and plant and animal tissues can be detected quantitatively by gas chromatography with an electron capture detector at 0.01 mg/l. Cleanup is satisfactory for paper and thin-layer chromatography for further identification of individual insecticides in the extracts. (Svensson-Washington) W72-10066

THE INVESTIGATION OF SHIGELLA IN WATER USING A TECHNIQUE OF FILTRATING MEMBRANES ASSOCIATED WITH A SOLID ISTRATI ENRICHING MEDIUM, (IN FRENCH), National Inst. of Public Health, Budapest (Hunga-

ry). D. Dang Nguyen, and S. Deak. Ann Inst Pasteur Lille. Vol 22, p 371-380. 1971. English summary. Identifiers: Istrati, Medium, Membranes, \*Shigel-la, \*Analytical techniques, Water analysis, \*Water

Analyses of 127 samples of sewage and surface waters were performed to detect Shigella. Germs previously concentrated by membrane filtration were isolated in Istrati medium. Glycerol buffered solution was added to protect and to inhibit bac-teriophages. By this method, 8 Sonne II, 2 Flexner 3a and 1 Flexner X were found, which represent 8.6/100 of the observed samples. Sewage water which contains a large amount of the pathogens from humans is more contaminated than surface water: the percentage of Shigella in sewage water was 17.8/100.--Copyright 1972, Biological Abstracts, Inc. W72-10096

AIRPHOTO ANALYSIS OF OCEAN OUTFALL

DISPERSION, Oregon State Univ., Corvallis. School of En-

gineering.
F. J. Burgess, and W. P. James.
Copy available from GPO Sup Doc, \$2.25;
microfiche from NTIS as PB-210 406, \$0.95.
Eviromental Protection Agency, Water Pollution
Control Research Series, June 1971. 297 p. 102 fig,
12 tab, 52 ref, 5 append. EPA Program 16070 ENS

Descriptors: \*Oregon, \*Aerial photography, \*Remote sensing, \*Photogrammetry, \*Outlets, \*Waste disposal, Currents (Water), Diffusion, Waves (Water), Wind velocity, Sampling, Boats, Correlation analysis.
Identifiers: \*Newport (Oreg), Photo interpretations

During the summers of 1968, 1969 and September 1970 to May 1971 aerial photographs were taken of the ocean outfall waste plume at Newport, Oregon. The principles of photogrammetry and photo interpretation were combined to analyze the photo interpretation were combined to analyze the photos. Waste concentrations, water currents and diffusion coefficients were yielded by this remote sensing system using multispectral photography. Concurrent boat sampling was conducted. Results of the two methods were compared and the correlation coefficient ranged from 0.85 to 0.95. Discrepancies between these figures stemmed from shifting of the waste field during the 2 hour boat sampling period. Dye drops from an airplane were used to evaluate proposed ocean outfall sites. Diffusion coefficients, current velocity, wind velocity, sea state and wave height were determined from the aerial photographs. Airphoto pattern elements are given for visual interpretation of the photography. (Ensign-PAI) W72-10146

BRITISH ISLES COASTAL WATERS: THE CONCENTRATIONS OF SELECTED HEAVY METALS IN SEA WATER, SUSPENDED MATTER AND BIOLOGICAL INDICATORS--A PILOT SURVEY, Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.

For primary bibliographic entry see Field 05B.

A CONVENIENT METHOD OF ANALYSIS OF HUMIC ACID IN FRESH WATER, University of South Florida, Tampa. Dept. of Chemistry; and University of South Florida, St. Petersburg. Marine Science Inst. D. F. Martin, and R. H. Pierce, Jr. Environmental Letters, Vol. 1, No. 1, p 49-52, 1971 11 aref

Descriptors: \*Humic acids, \*Water analysis, \*Analytical techniques, Chelation, Water chemis-Freshwater, Colorimetry, Separation

A convenient method for determining the humic acid content of natural waters is described. A stock solution of humic acid was prepared from the dried substance, which was obtained by an extraction procedure according to the operational definition of humic acid. Aliquots of the stock solution were measured on a Bausch and Lomb Spectronic 20 at 520 millimicrons wavelength, and a linear calibration plot was obtained. Natural samples were extracted and run similarly. (Svensson-Washington) W72-10201

CORRELATION OF DDT AND LIPID LEVELS FOR CERTAIN SAN FRANCISCO BAY FISH, Bureau of Sport Fisheries and Wildlife Sacramento, Calif. Div. of River Basin Studies. For primary bibliographic entry see Field 05C. W72-10203

SPENT SULFITE LIQUOR XIII. THE VANILLIN METHOD FOR ESTIMATION OF THE CONCENTRATION OF SPENT SULFITE LIQUOR IN WATERS, Washington Univ., Seattle.

For primary bibliographic entry see Field 05D.

GENERALIZED EQUATIONS FOR CRITICAL OXYGEN DEFICIT, Camp, Dresser and McKee, Boston, Mass. K. M. Yao. Water and Sewage Works, Vol 117, No 12, December 1970, p 426-429. 1 fig, 2 ref.

Descriptors: \*Mathematical studies, \*Computer programs, \*Water pollution effects, \*Dissolved oxygen, Stream improvement, Tidal effects, Mixing, Mathematical models.

Identifiers: Camp equation, Dissolved oxygen deficit, Longitudinal mixing.

The equations for determining the location and magnitude of the critical oxygen deficit based on Camp's equation were presented. Camp's equa-tion was used because it contains terms represent-ing factors such as BOD exerted by bottom deposits and photosynthetic oxygen production. Camp's equations both for nontidal reaches with negligible longitudinal mixing and for tidal reaches

### Group 5A-Identification of Pollutants

with significant longitudinal mixing were considered. The equations presented were reported to be valid for the Thomas equation as well as the Streeter-Phelps equation for stream pollution stu-dies. Numerical examples with manual and computer solutions were included to illustrate the practical applications of the developed equations.

Basic Fortran IV Language was used in programming. (Galwardi-Texas)

W72-10221

FITTING FIRST AND SECOND ORDER BOD REACTION EQUATIONS TO STREAM DATA, Illinois State Water Survey, Peoria. Water Quality Section.

T. A. Butts, and V. Kothandaraman. Water and Sewage Works, Vol 117, No 8, August 1970, p 276-278. 2 fig, 3 tab, 5 ref.

Descriptors: \*Biochemical oxygen demand. \*Stream stabilization, \*Mathematical models, Laboratory tests, Computer programs, Statistical models, Least squares method, Data processing, Digital computers, Illinois, River forecasting.
Identifiers: Woodward equation, Streeter-Phelps equation, Reed-Theriault method, Illinois River, First order equations, Second order equations, Standard error of estimate.

As part of a comprehensive waste assimilative study of the Illinois River, river water samples were collected for BOD determinations at various locations. To determine whether the BOD data best fit first or second order reaction curves, comparisons were made between the monomolecular reaction for biochemical oxygen demand, and the Woodward equation which represents the theory that the rate of reaction is not constant but changes with time. First order curves were fitted to the observed data using the Reed-Theriault method, a trial and error technique on a digital computer. Solutions to the second order equation were determined by linearizing the data and using least squares statistical methods. The standard error of estimate was used for determining the precision obtained in fitting the curves to the observed data. The results were arranged in tabular form and the standard error for the first order equation was smaller for 23 of 28 samples. Several of the standard errors for the second order model were large and were reported to be the result of a slight lag in the first day BOD. Thus it was shown that the first order equation fits Illinois River BOD curves much better than does the second order equation, and the use of a waste assimilative model based on the Streeter-Phelps oxygen sag equation was justified. (Galwardi-Texas) W72-10222

A FREEZING CORE METHOD FOR DESCRIB-ING THE VERTICAL DISTRIBUTION OF SEDI-MENTS IN A STREAMBED,

Waterloo Univ. (Ontario). Dept. of Biology. For primary bibliographic entry see Field 07B. W72-10240

COMPARISON OF A GRAB SAMPLER AND LARGE VOLUME CORER, Georgia Univ., Sapelo Island. Marine Inst. For primary bibliographic entry see Field 07B.

W72-10249

A SIMPLIFIED METHOD FOR THE DETER-MINATION OF SELENIUM IN SOILS AND SEDIMENTS,

Food and Agriculture Organization of the United Nations, Pendik (Turkey). Sheep and Goat Diseases Research Labs.
W. R. T. Hemstead, M. Sina, and S. Cekicer.

Analyst, Vol 97, No 1154, p 383-387, May 1972. 1 tab. 11 ref.

Descriptors: \*Soil chemistry, \*Chemical analysis, \*Sediments, \*Pollutant identification, \*Analytical techniques, Soil water, Leaching, Soil analysis. Identifiers: \*Selenium.

A method is described for the determination of low levels of selenium in soils. An extract of the soil in nitric acid and orthophosphoric acid is prepared. An aliquot is oxidized with potassium persulphate at 100 C, at which temperature the loss of selenium is minimal. The excess of nitric loss of selenium is minimal. The excess of nitric acid is removed by evaporation and 50% hydrochloric acid is added to reduce selenate. The selenite produce is complexed with 2,3-diaminonaphthalene and the resulting 4,5-benzopiazselenol is extracted with cyclohexane. Sodium sulphate is added to remove interfering substances and the selenium complex is determined fluorimetrically. Selenium in soils down to 0.04 mg/liter can be determined to within plus or minus 0.1 mg/liter. (Woodard-USGS) W72-10252

THE DETERMINATION OF THE NON-VOLATILE ACID'TY OF RAIN WATER BY A COULOMETRIC PROCEDURE, Rome Univ. (Italy). Istituto di Chimica Aanlitica. For primary bibliographic entry see Field 07B.

W72-10254

A FULLY AUTOMATED METHOD FOR THE DETERMINATION OF CHEMICAL OXYGEN

DEMAND, Imperial Coll. of Science and Technology, London (England). Dept. of Chemistry. B. Fleet, and A. Y. W. Ho. Analyst, Vol 97, No 1154, p 321-333, May 1972. 8

fig. 7 tab. 19 ref.

Descriptors: \*Chemical analysis, \*Chemical oxygen demand, \*Analytical techniques, \*Electrodes, Water chemistry, Instrumentation, Laboratory tests, Organic wastes, Water pollution, Colorimetry, Pollutant identification, Water pollution sources pollution sources. Identifiers: Silver electrode.

The determination of chemical oxygen demand based on the use of a porous catalytic silver electrode is described. The conditions used in the digestion step are essentially the same as for the standard method, but the amount of oxidant (dichromate or permanganate) consumed is determined by allowing the excess of oxidant to react with hydrogen peroxide to liberate oxygen, which is measured colorimetrically by the electrochemical sensor. The effectivenessof the automated method as a detector of organic pollution is as-sessed by studying the oxygen absorbed values of synthetic sample solutions of several pure organic compounds. Percentage oxidation values are cal-culated and compared with those obtained with standard methods. Various aspects of inter-ferences and their removal are also discussed. (Woodard-USGS) W72-10255

A STATISTICAL METHODOLOGY FOR PRE-DICTING THE POLLUTANTS IN A RIVER, Mississippi State Univ., State College. For primary bibliographic entry see Field 05B. W72-10266

ON ROUTINE COLORIMETRIC DETERMINA-TION OF TRACE NITRATES, BY BRUCINE, IN THE PRESENCE OF CHLORIDE, Consiglio Nazionale delle Ricerche, Rome (Italy). Centro Nucleazione Aerosoli.
G. L. Petriconi, and H. M. Papee.
Water, Air, and Soil Pollution, Vol 1, No 1, p4249, November 1971. 3 fig, 1 tab, 35 ref.

Descriptors: \*Water analysis, \*Nitrates, \*Colorimetry, Pollutant identification, Chemical analysis, Laboratory tests, Analytical techniques. Identifiers: \*Brucine.

A colorimetric method was developed for the determination of trace nitrates in solutions containing up to 50 g per liter of sodium chloride. Beer's law applies in such solutions for concentrations of up to 1 mg of NaNO3 per liter. Effects of sodium chloride concentration and time on the development of color were quantitatively evalu-ated with an overall error of about4%. Tempera-ture effects on solutions analyzed were found to be a major cause of inconsistencies in this othersatisfactory method. (Knapp-USGS)

WATER POLLUTION IN LAKE MICHIGAN BY TRACE ELEMENTS FROM POLLUTION AEROSOL FALLOUT, Michigan Univ., Ann Arbor. For primary bibliographic entry see Field 05B. W72-10329

CHLORINATED NAPHTHALENES IN PESTI-CIDE ANALYSIS, Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 07B. W72-10349

AUTOMATION OF WATER ANALYSIS AND ANALYTICAL PROCESS INSTRUMENTATION. boro Co., Mass.

R. H. Babcock. Journal of the American Water Works Associa-tion, Vol 62, No 3, p 145-148, March 1970. 4 fig.

Descriptors: \*Automation, \*Water analysis, Analytical techniques, Instrumentation, Environment, Conductivity, Laboratory tests, Sampling, Turbidity.

Identifiers: Nernst equation. Wet chemistry. Detectors, Sampling systems, Photomultiplier tubes, Photoelectric cells.

Automation of both analytical and analog measurement and control is becoming increasingly important in the water supply field. Laboratory measurements are made in a controlled environment, while analytical measurements take place in an uncontrolled environment. Automation of process analytical measurements requires trained personnel and properly designed handling systems. (Given as an example is a typical bad and good sample handling system to draw water from a clear well to measure residual chlorine). Automation also requires: sample handling system to preserve the representativeness of the sample taken; detectors to measure different variables utilizing measurement of resistance, amperage and voltage, utilizing ion-selective electrode in conjunction with a constant voltage source; readout devices; and automatic control devices. The automation of water analysis could be achieved by providing the necessary trained mappower having a thorough understanding of all the capabilities and limitations of the equipment used. (Andrews-AWWARF) W72-10359

DISEASE DUE TO 'NONPATHOGENIC' BAC-TERIA, South Tahoe Public Utility District, South Lake Tahoe, Calif. For primary bibliographic entry see Field 05F.

DETERIORATION OF WATER QUALITY IN DISTRIBUTION SYSTEMS, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 05F. W72-10374

ANALYSIS OF ALKALINE PULPING LIQUOR WITH SULFIDE ION-SELECTIVE ELECTRODE, Foxboro Co., Mass. For primary bibliographic entry see Field 05D. W72-10385

MEASUREMENT OF TOTAL SOLIDS IN W72-01245 KRAFT BLACK LIQUORS, Kimberly-Clark Corp., Neenah, Wis. For primary bibliographic entry see Field 05G. W72-10419 USA TODA

### 5B. Sources of Pollution

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CHARACTERISTICS OF MANURE ACCUMU-LATIONS REMOVED FROM OUTDOOR, UN-PAVED, BEEF CATTLE FEEDLOTS, Agricultural Research Service, Lincoln, Nebr. C. B. Gilbertson, T. M. McCalla, J. R. Ellis, and W. R. Woods. In: Livestock Waste Management and Pollution

Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 56-59, 6 fig., 4 tab., 8 ref.

Descriptors: \*Farm wastes, Cattle, Feed lots, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen.
Identifiers: \*Nebraska Field Laboratory, Unpaved feedlots, \*Waste characteristics.

Manure management is a necessary practice for beef feedlot operators unless area provided per animal is great enough to eliminate significant manure buildup on the feedlot surface. A study was initiated in 1968 to determine the effect of surwas intuated in 1996 to determine the effect of surface slope and cattle density on the quantity and quality of manure accumulation on outdoor beef feedlots. New feedlots with 3, 6, and 9% slopes were completed in July, 1968. Cattle were placed in each pair of lots at densities of 100 and 200 sq. ft. per head. Results have shown that considerable soil was mixed with accumulated manure by norsoil was mixed with accumulated manure by normal cattle movement within the lot. Dry matter removed from the lots averaged 2.3 times more for cattle densities of 100 sq. ft. per head than for lots with cattle densities of 200 sq. ft. per head. Feedlot slope appeared to have little effect on the amount of material removed. Approximately 30% of the total solids removed was volatile. BOD and COD values were highly variable. Further, each ton of dry matter removed contained 24 to 34 pounds of N. (See also W72-09940) (Bundy-Iowa State) W62-09954

TRAVELTIME AND CONCENTRATION ATTENUATION OF A SOLUBLE DYE IN ANTIETAM AND CONOCOCHEAGUE CREEKS, MARYLAND, Geological Survey, Parkville, Md. K. R. Taylor and W. B. Solley. Maryland Geological Survey Information Circular 12, 1971. 25 p, 11 fig, 4 tab, 10 ref.

Descriptors: \*Dye releases, \*Streamflow, \*Travel time, Fluorescent dye, \*Maryland, Path of pollutants, Tracking techniques, Tracers, Water pollution sources, Flow rates, Forecasting.

Identifiers: \*Antietam Creek (Md), Conococheague Creek (Md).

Three time-of-travel studies, using a fluorescent dy-, were conducted on Antietam Creek and Conococheague Creek in Maryland during 1969 and 1970. The studies were made on Antietam and 1970. The studies were made on Antietam Creek at flow-duration points of approximately 75, 40, and 12 percent, and on Conococheague Creek at flow-duration points of approximately 90, 3, and 15 percent. Time-distance relations are defined for a range of discharges from 90 to 500 cfs at the index gage on Antietam Creek, and from 90 to 1,000 cfs at the index gage on Conococheague Creek. These relationships can be used to need to the traveltimes of the leading edge. Conococheague Creek. These relationships can be used to predict the traveltimes of the leading edge, peak concentration, and trailing edge of a soluble contaminant spilled into these creeks at any point in Maryland. Graphs in the report can be used to predict the upper limit of concentration expected from any amount of soluble contaminant introduced at any point on Antietam and Conococheague Creeks in Maryland and at any discharge in the range of flows studied. (Woodard-USGS)

INDUSTRIAL WASTE TREATMENT IN THE USA TODAY, Department of the Interior, Washington, D.C. For primary bibliographic entry see Field 05D. W72-09835

CHEMICAL AND PHYSICAL CHARAC-TERISTICS OF WATER IN ESTUARIES OF TEXAS, OCTOBER 1968-SEPTEMBER 1969, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 02L. W72-09855

THE DISTRIBUTION OF MERCURY IN THE SEDIMENTS OF LAKE ONTARIO, Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

R. L. Thomas.
Canadian Journal of Earth Sciences, Vol 9, No 6, p 636-651, June 1972. 6 fig, 4 tab, 33 ref.

Descriptors: \*Water pollution sources, \*Bottom sediments, \*Mercury, \*Lake Ontario, \*Path of pollutants, Canada, Sampling, Heavy metals, In-

Total mercury was analyzed in the top 3 cm of sediment from 287 sample stations in Lake Ontario. Well-defined trends can be related to sediment type; the concentration of mercury increases from the shallow nearshore coarse sediments into the central, deep-water basin sediments composed of fine silty clays and clays. The average concentration of mercury in the nearshore sediments is 355 ppb, in the basin sediments 997 ppb and the average for the whole lake is 651 ppb. Regions of average for the whole lake is 651 ppb. Regions of high mercury concentration occur along the southern margin of the main lake basin and in the western (Niagara) basin. The Niagara River is the prime source of mercury input. Most of this mercury is of industrial origin. An additional area of high mercury concentration occurs at the eastern sea of I have Optario (Kingata) Pagin) close to the end of Lake Ontario (Kingston Basin) close to the outlet to the St. Lawrence River. These high values in organic-rich, fine sediments are related to processes of biological concentration. The concentrations . mercury in the recent sediments of centrations. Insertury in the recent seuments of Lake Ontario can be accounted for by an average minimum daily input of 125 lb of mercury of which an estimated 42 lb is of natural origin and the remaining 83 lb is from industrial sources. The vertical distribution of mercury in a selected sediment core suggests that industrial mercury input com-menced about the turn of the century, rose rapidly to 1943 and, since then, has shown a slow but con-tinued rise to 1970. (Knapp-USGS)

ON CS-134 IN RAINWATER FROM 1960 TO

1969, Comitato Nazionale per L'Energia Nucleare, Casaccia taly). laboratorio Radioattivita Ambien-

tale.

A. A. Cigna, G. F. Clemente, and F. G. Giorcelli.

Health Physics, Vol 21, No 4, p 667-672,

November 1971. 2 fig, 1 tab, 24 ref.

Descriptors: \*Cesium, \*Nuclear explosions, \*Fal-lout, \*Water pollution sources, Rainfall, Analyti-cal techniques, Chemistry of precipitation, Foreign research, Radioisotopes, Soil contamina-tion, Environmental effects, Assessments. Identifiers: \*Artificial radionuclides, World-wide contamination.

A critical analysis is given of the mechanisms of production and deposition of cesium-134 based upon all available data. Cs-134 was measured in rainwater samples collected monthly at the Casaccia Nuclear Center (Rome). A gamma-gamma su coincidence technique was used on pooled yearly samples after a chemical separation of Cs. The results of these measurements are reported and compared with similar results obtained by others. Analysis of the data led to the hypothesis that a major amount of this nuclide could have been injected into the stratosphere by nuclear tests before 1961. Contributions of the 1961 and 1962 explo-1961. Contributions of the 1961 and 1962 explosions were less than expected. The first Chinese test in 1964 contributed to Cs-134 concentration in rainwater. The average Cs-134/Cs-137 ratio was abown 1 per mille during the period 1961-1969. On the basis of data presented, the origin of Cs-134 world-wide contamination is nuclear test explosions. (Lang-USGS) W72-09873 W72-09873

OIL DUMPING BY U.S. NAVY. Congress, Washington, D.C.; and House, Washington, D.C. For primary bibliographic entry see Field 05G. W72-09890

NITRILOTRIACETIC ACID: A LITERATURE SURVEY, Water Pollution Research Lab., Stevenage (England). N. S. Thom Water Res. Vol 5, No 7, p 391-399, 1971.
Identifiers: \*Acetic acid, \*Reviews,
\*Nitrilotriacetic acid, \*Water pollution effects.

There is no doubt that NTA (nitrilotriacetic acid) is substantially biodegradable. Unfortunately conditions of sewage treatment vary widely and so some of the NTA reaching a sewage work will find its way into rivers particularly during cold spells and from less efficient sewage works; some may also enter rivers from storm overflows on combined sewage systems. The NTA will carry with it toxic metals, such as Cd, Cu, Ni, and Zn and inform tion is inadequate to predict whether or not this will be harmful to river life. In the short term a reduction in the toxicity of these and other metals to sewage treatment processes and to fish may be expected, but no data are available about long-term effects. It is likely that there will be a reduction in removal of metals at sewage works and this may be a mixed blessing. Due to the uncertainty of the effects of NTA, combined with the possibility of replacement of phosphates by NTA in synthetic of replacement of phosphates by NTA, in synthetic on the 'phosphate problem'. It seems unwise to replace the phosphates by NTA, particularly as phosphates are generally harmless natural nutrients, and have come into prominence only as

CARCINOGENS IN THE SEWAGE OF PETROLEUM-PROCESSING FACTORIES, For primary bibliographic entry see Field 05C.

a result of excessive algal growths.--Copyright 1972, Biological Abstracts, Inc.

LIVESTOCK WASTE MANAGEMENT AND POLLUTION ABATEMENT. For primary bibliographic entry see Field 05G. W72-09940

MEASUREMENT OF RUNOFF AND RUNOFF CARRIED WASTE FROM COMMERCIAL FEEDLOTS, South Dakota State Univ., Brookings. Dept. of

South Dakota State Univ., Brookings. Dept. of Agricultural Engineering.

J. M. Madden, and J. N. Dornbush.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 44-47, 2 fig., 6 tab., 4 ref.

Descriptors: \*Farm wastes, Feed lots, Runoff, Biochemical oxygen demand, Chemical oxygen demand, Phosphate, Cattle, \*South Dakota, Path

### Group 5B-Sources of Pollution

The objectives were to (1) determine the quantity and quality of runoff from livestock feeding operations in South Dakota, (2) to relate the above infor-mation to hydrological and geological considerations in order to appraise the overall influence of this runoff on specific beneficial uses of receiving water, (3) determine the influence of spring runoff as it occurs in northern climates, and (4) determine the pollutional characteristics attributable to the suspended matter in the feedlot runoff in order to extrapolate the effectiveness of proposed lagooning methods of treatment. Measurements have been made on four commercial sized feedlots for two years and an additional two lots for one year. rwo years and an additional two lost for one year. Runoff has been quantified and composite and grab samples have been analyzed to determine the BOD, COD, dissolved and suspended solids, nitrogen forms, and phosphate content. The results have been used in the development of codlets results in the development of the state of the codlets results in the development of the state of the codlets results in the development of the state of the codlets results in the development of the state of the codlets results in the development of the state of the s feedlot regulations and engineering standards for the control of feedlot runoff. Suggestions are also being made as to the type of treatment and management practice which will reduce the pollu-tion potential. (See also W72-09940) (Bundy-Iowa W72-09951

TRANSPORT OF POLLUTANTS FROM SLOP-ING CATTLE FEEDLOTS AS AFFECTED BY RAINFALL INTENSITY, DURATION, AND RECURRANCE.

Agricultural Research Service, Lincoln, Nebr. Soil and Water Conservation Research Div.

N. P. Swanson, L. N. Mielke, J. C. Lorimor, T. M. McCalla, and J. R. Ellis.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 51-55, 4 fig., 4 tab., 9 ref.

Descriptors: \*Farm wastes, Feed lots, Runoff, Cattle, Microorganisms, Rainfall, Nitrogen, Phosphorus, E. Coli, Bacteria, Fungi, Coliform, Crops, Path of pollutants, \*Central U.S. Identifiers: Rainfall simulator.

The pollution of surface waters by cattle feedlot runoff is of serious concern in the midwestern United States. Pollutants are transported in solution, in suspension, and as bedloads by feedlot runoff. The pollutants may be chemicals, microor-ganisms, organic materials, and soil sediments. Research on a feedlot instrumented for continuing runoff measurement and sampling, and research using a rainfall simulator on runoff plots on 8- and 13-percent slopes in another feedlot indicate that the pollution potential is not a direct function of only the yield of runoff. In one experiment on an 8-percent slope, a simulated rain of 2.8 inches per hour provided runoff with initial rates of loss per acre per hour of 4680 lbs. of total solids, 1160 lbs. volatile solids, 11.6 lbs. phosphorus, and 66.9 lbs. of organic nitrogen. Both the chemical contents of runoff (conductivity, total N, NH4N, NO3N, and COD) and the volume of solids decreased with continuing runoff. Runoff samples contained appreciable numbers of E. coli, Enterococci, total bacteria, fungi, bacilli, and clostridium. Higher intensities of rainfall provide added energy for in-creased detachment and transport of solids which adds to the pollution potential of each unit of ru-noff. The chemical content of feedlot runoff is compared with analyses of runoff from cropland recently published by other researchers in the mid-western United States. (See also W72-09940) (Bundy-Iowa State) W72-09953

LAND DISPOSAL OF CATTLE FEEDLOT

Kansas State Univ., Manhattan. Dept. of Agricul-

tural Engineering. H. L. Manges, L. A. Schmid, and L. S. Murphy. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 62-65, 4 fig., 1 tab., 4 ref. Descriptors: \*Farm wastes, Cattle, Feed lots, Runoff, Lagoon, Rainfall, Nitrogen, Phosphorus, Corn, Irrigation, Chemical oxygen demand, Crop Identifiers: \*Pratt Feed lot.

The objectives are 1) to characterize stormwater runoff from a feedlot, 2) to characterize manure generated in a feedlot, and 3) to determine the in-fluence of different lagoon water and manure loadings on the soil, stormwater runoff from the disposal area, and corn yields. Analyses of runoff from rainfall have shown a COD of 4,000 to 10,000 mg/1, nitrogen of 100 to 800 ppm., phosphorus of 40 to 500 ppm. and total salts of 5,000 to 6,000 ppm. Analyses are being made to determine the concentration of other cations. Runoff from snowmelt has had a pollution load several times that from rainfall. During 1970, corn was grown on plots which received 0, 2, 4, 8, and 16 inches of lagoon water. Each plot was replicated 4 times and irrigated with well water as needed. Forage corn yields were measured. During 1970, corn also was grown on plots on which manure was plowed down at rates of 0, 10, 20, 40, 80, 160, and 320 tons per acre. Each plot was replicated four times and irrigated with well water. The manure was relatively high in nitrogen, calcium, iron and potassium with lesser amounts of magnesium, phosphorus, sodium and zinc. Plant population decreased as rate of manure application increased. Forage yields increased as rate of manure application increased up to 80 tons per acre. Above 80 tons manure per acre, corn yields were depressed. (See also W72-09940) (Bundy-Iowa State) W72-09956

EVALUATION OF BEEF FEEDLOT WASTE MANAGEMENT ALTERNATIVES,

Oklahoma State Univ., Dept. of Agricultural Engineering. Stillwater.

A. F. Butchbaker, J. E. Garton, G. W. A. Mahoney, and M. D.. Paine.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22 1971, p. 66-69, 6 fig., 2 tab., 6 ref.

Descriptors: \*Farm wastes, \*Pacific Northwest U.S., Waste treatment, Waste disposal, Cattle, \*Feed lots, Confinement pens, Runoff, Design, Costs, \*Design criteria, Southwest U.S., Central U.S., Computer programs.
Identifiers: Southern High Plains, Liquid flush system. Slotted floor.

The objectives were: (1) to develop beef feedlot design criteria to minimize pollution from runoff-carried wastes and to facilitate handling of solid and liquid animal wastes, and (2) to examine alternative beef feedlot waste disposal systems to obtain minimum cost systems for effective waste disposal. Waste handling systems for beef feeding operations were observed in the upper Midwest, Southern High Plains, desert Southwest, and Pacific Northwest The systems studied included: slurry, solid, and runoff-carried waste handling systems. The ultimate disposal of the waste material was considered for each system. The design criteria developed represents the state of the art for most design considerations for confinement feeding facilities and open feedlot facilities. The results are presented in terms of flow diagrams and graphs comparing the various systems. (See also W72-09940) (Bundy-Iowa State)

THE WASTE PATTERN OF BEEF CATTLE ON SLATTED FLOORS.

Agricultural Research Service, St. Paul, Minn. Livestock Engineering and Farm Structures Livestock Research Branch.

R. O. Hegg, and R. E. Larson.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 70-72, 2 fig., 4 tab., 8 ref. Descriptors: \*Farm wastes, Cattle, Confinement pens, Oxidation lagoons, Water pollution, Aerated lagoons, Path of pollutants.
Identifiers: \*Slatted floors, High energy ration.

The distribution of wastes from beef cattle on a slatted floor with respect to the location of the feeding area and the watering area was determined. Seven trials were run to determine the waste pattern on a slatted floor over an oxidation ditch at the University of Minnesota Experiment Station at Rosemount, Minnesota. The first four trials (I-IV) were run with the self-feeder and waterer along the same side of the slatted floor area. Trials (V-VII) were run with a waterer against the wall opposite the self-feeder. Trials I through IV show that approximately 60% of the urine and 60% of the fecal matter were collected on the half of the floor that was nearest the feeder and the waterer. Moving the waterer to the opposite wall for trials V-VII changed the urine pattern such that 62% of the liquid was collected on that half of the floor nearest the new location of the waterer. The fecal pattern also changed but not to the extent that the urine pattern changed. The average daily collection of total dry solids ranged from 3.1 to 5.2 lbs/animal. The average total liquid collected each day ranged from 1.3 gallons to over 4 gallons/animal. The trials indicate that placing e waterers and feeders in one area of the confinement unit tends to concentrate the wastes in that area. (See also W72-09940) (Bundy-Iowa State) W72-09958

DIFFERENTIATION OF RUMINANT FROM NON-RUMINANT FECAL SOURCES OF WATER POLLUTION BY USE OF ENTERIC

BACTERIA, South Dakota State Univ., Brookings. Dept. of Bacteriology.

P. R. Middaugh, L. R. Koupal, R. L. Pierce, Jr., J. E. Tiede, and J. W. Zerfas.

In: Livestock Waste Management and Pollution

Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 126-128, 1 fig, 35 ref.

Descriptors: \*Farm wastes, Runoff, \*Coliforms, Microorganisms, Bacteria, Streptococcus, Nitrogen, Cattle, Sheep, Goats, Lagoons, Pollu-tant identification. Identifiers: \*S. bovis, Fecal pollution

Studies on methods for improving the land disposal of anima wastes or on methods to minimize storm run-off waste pollution of streams or lakes would be aided if feed lot wastes in water could be differentiated from non-ruminant or human waste sources. A laboratory study was based on the presence of a fecal streptococcus, Streptococcus bovis, in feces of ruminant farm animals, cattle, sheep and goats which have from 1 to 20 million cells per ml. of rumen fluid. In a preliminary survey of fecal streptococci occurring in lakes and rivers and in municipal wastes and a dairy lagoon the predominant organism was Streptococcus faecalis and its varieties which represented 90% of the fecal streptococci. S. bovis constituted only 3% of the streptococci. The standard media used to cultivate gut bacteria were highly inhibitory for S. bovis cells which were added to water samples. An improved medium with reduced sodium azide, 0.02%, improved anaerobic culture conditions and the quantitative collection of the bacteria on membrane filters led to a selective method using a starch hydrolysis overlay. The improved medium quantitatively de-tected S. bovis bacteria added to river water samples and allowed their routine isolation. Of the isolates, 92% were found to be Streptococcus bovis and 8% were S. faecalis variety liquefaciens. To be an effective pollution indicator, S. bovis must survive sufficiently to be readily detected. (See also W72-09940) (Bundy-Iowa State)

GROWTH KINETICS OF RUMEN BACTERIA IN SOLUTIONS OF POULTRY EXCRETA, Kentucky Univ., Lexington. H. E. Hamilton, I. J. Ross, J. J. Begin, and S. W.

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In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 129-131, 8 fig, 12 ref.

Descriptors: \*Farm wastes, Poultry, Feeds, Hydrogen ion concentration, Microorganisms, Growth rates, Cattle.

Poultry excreta contains nutrients that can be utilized as a livestock feed. Successful feeding trials with untreated litter have proven the feasibility of utilizing excreta as a feedstuff. Excreta from hens fed a drug-free diet was blended and diluted with water, sterilized, and placed in a fermentor equipped with an indirectly driven agitator, automatic pH controller, temperature controller, foam controller, and sampling device. The solution was then inoculated with rumen fluid from a steer being maintained on a diet containing sterilized being maintained on a diet containing sterilized chicken manure and fermented anaerobically for chicken manure and fermented anaerobically for 48 hours. Samples were taken as the fermentation process progressed and diluted and plated for microflora counts. The colonies in the inoculated tubes were counted after 7 days of incubation. There was logarithmic growth beginning about three hours after inoculation and subsiding about ten hours after inoculation and subsiding about ten hours after inoculation. High solids levels decreased the maximum population and increasing and/or decreasing the pH from that in the rumen altered the maximum population. (See also W72-altered the maximum population. (See also W72altered the maximum population. (See also W72-09940) (Bundy-Iowa State) W72-09975

QUALITY OF EFFLUENT FROM FARM ANIMAL PRODUCTION SITES, Louisiana Tech Univ., Ruston. Dept. of Agricul-

tural Engineering.
J. W. D. Robbins, G. J. Kriz, and D. H. Howells. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 166-169, 5 fig, 4 tab, 4 ref.

Descriptors: \*Farm wastes, Coliforms, Biochemical oxygen demand, Chemical oxygen demand, Carbon, Lagoons, Runoff, Water pollution sources, Water pollution control, Waste disposal.

Effluents from twelve animal production sites representing three types of waste management operations—land disposal, lagooning and direct discharge into streams—were measured and more than 1500 samples were collected for analyses. The water samples were analyzed for (a) bacterial densities—total coliforms, fecal coliforms and fecal streptococci; (b) degradable organica-biochemical oxygen demand, total organic carbon, total solids and volatile solids; and (c) nutrients—organic nitrogen, mitrogen, mitrogen, nitrate nitrogen, nitrite nitrogen, total phosphate and orthophosphate. Other measurements included pH, conductivity, initial dissolved oxygen and temperature. Site data were collected in order to evaluate the pollutional potential of each site and the management factors determining the amount of wastes that reached water courses. These data included the number and size of animals, types Effluents from twelve animal production sites included the number and size of animals, types and amounts of feeds, types of waste handling facilities and practices, waste retention or drainage times, soil classifications, rainfall, temperature, flow rates and some characterization of wastes produced. Study results point to the need wastes produced. Study results point to the need for and superiority of land disposal for animal wastes to effectively control water pollution. Direct dumping of animal wastes into streams is essentially predictable by characterization of fresh wastes and should be prohibited. Effluents from waste lagoons were found to exceed raw domestic sewage in strength and should not be discharged without further treats (See also W72.00940) without further treatment. (See also W72-09940) (Bundy-Iowa State) W72-09985

WATER AND SOIL OXYGEN DEMAND OF LIVESTOCK WASTES, Ohio State Univ., Columbus. Dept. of Agricultural

Ohio State Univ., Colonia Engineering.
E. P. Taiganides, R. K. White, and R. L. Stroshine.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971. p 176-179, 7 fig. 4 tab, 7 ref.

Descriptors: \*Farm wastes, Sulfur, Carbon, Nitrogen, Waste treatment, Biochemical oxygen demand, Analytical techniques. Identifiers: \*Soil oxygen demand, Winkler method, Warburg respirometer.

The oxygen demands of animal manures placed in a water environment were measured using the standard BOD dilution-bottle technique and the Warburg respirometer method, using seeded and unseeded samples and incubating the samples at temperatures ranging from 12 deg. Cto 28 deg. C. It was concluded that oxygen demand units should be reported in mg O2 per gram of total solids (mg/g TS) or as percent of TS. Seeding animal manure samples with supernatant from aerated sewage produced a significantly higher BOD curve than for unseeded samples. Total BOD (56 days at 20 deg. C) of animal manure constituted 40 to 50 percent of the COD, but the 5-day BOD is less than 14 percent of the COD of the same waste. Either the Winkler method or oxygen meter may be used with similar accuracies in the measurement of dissolved oxygen in BOD bottles. Warburg respirometer is a good apparatus to use to determine oxygen demand of animal wastes. A test to measure the rate and ultimate oxygen demand of animal manure incorporated into top soil is called The oxygen demands of animal manures placed in measure the rate and ultimate oxygen demand of animal manure incorporated into top soil is called Soil Oxygen Demand (SOD). In the SOD test, waste is placed in an air-tight Warburg flask containing soil. As microbes decompose the waste, oxygen is consumed and carbon dioxide is released. The carbon dioxide is absorbed by a solution of 40 percent potassium hydroxide which is placed in a vial in the flask. The quantity of oxygen consumed is determined by measuring changes in the pressure in the flask and calculating the change in quantity of gas, using the ideal gas law. (See also W72-09940) (Bundy-lowa State) W72-0998

FATE OF INORGANIC FORMS OF N AND SALT FROM LAND-DISPOSED MANURES FROM DAIRIES, California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.

D. C. Adriano, P. F. Pratt, and S. E. Bishop.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 243-246. 1 fig. 7 tab, 8 ref.

Descriptors: \*Farm wastes, \*Nitrates, \*Leaching, Ammonia, Denitrification, Salts, Chlorides, Cat-tle, Path of pollutants, Waste disposal. Identifiers: \*Field-spreading.

Because land disposal without pretreatment is the most common method of disposal of cattle wastes in Southern California, salts and nitrates in soils and groundwaters must become important factors in dairy waste management. Average nitratenitrogen concentrations of 92, 74, and 66 ppm in soil solutions at the 10 to 19 foot depth for corrals, pastures, and croplands, respectively were found in the Chino-Corona dairy area. These solutions will eventually reach the underlying groundwater, which at the time of sampling, had lower nitrate concentrations. Reducing the present cow population of 10 per disposal acre to about 3 per acre would keep nitrate-nitrogen levels at less than 10 ppm in soil solutions beyond the root zone, in soil profiles under croplands and pastures. Under existing conditions, manure from 20 dairy cows had about the same amount of salt as 3 acre-feet of irrigation water. Maximizing ammonia volatilization from manure before incorporation into the soil will reduce the nitrate-nitrogen pool in the soil. (See soil solutions at the 10 to 19 foot depth for corrals, reduce the nitrate-nitrogen pool in the soil. (See also W72-09940) (Schmitt-Iowa State) W72-10008

GROUNDWATER POLLUTION DUE TO HIGH ORGANIC MANURE LOADINGS, Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences. T. J. Concannon, and E. J. Genetelli. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971. p 249-253, 4 fig. 3 tab, 15 ref.

Descriptors: \*Farm wastes, \*Groundwater, Water pollution, Salinity, Poultry, Fertilization, Bio-indicators, Sampling, Waste disposal. Identifiers: \*Groundwater pollution.

Four specific methods of disposing of organic manures utilize soil as the ultimate disposal media. These include lagooning, sanitary landfilling, subsoil injection, and the PFC method. All these methods could cause serious pollution of ground waters due to heavy loadings of organic and inorganic carbon (TOC), NH4+, SO4, PO4, Cl, Na, Mg, Ca, and K. Bacteriological analyses were also performed. Four loading rates, 0, 15, 30 and 45 tons of dry poultry solids per acre were used in field plots as well as laboratory soil columns. Although TOC concentration levels were high in the field plots, no significant difference could be found between control and treatments. Nitrate concentrations exceeded USPHS limits, but the levels were not significantly different from the control. Chloride concentration did not exceed USPHS limits, sulfate concentrations slightly exceeded. USPHS limits, sulfate concentration and not exceed USPHS limits, sulfate concentrations slightly exceeded the limits. All fecal coliform tests were negative. Soil columns provided a controlled means for studying the soil as an effective disposal media for solid waste. (See also W72-09940) (Schmitt-Iowa State)

SUBSURFACE DISPOSAL OF LIQUID

MANURE, Pennsylvania State Univ., University Park. Dept. of Soil Fertility.

H. D. Bartlett, and L. F. Marriott.

In: Livestock Waste Management and Pollution

Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 258-260, 2 tab, 3 fig.

Descriptors: \*Farm wastes, \*Waste disposal, Underground waste disposal, Fertilization, Waste storage, Cattle.
Identifiers: Field-spreading.

The application of animal manure below the soil The application of animal manure below the soil surface provides a disposal method which eliminates problems of odors, flies, and runoff. Available equipment applies liquid manure four inches below the surface at approximately one gallon per square foot, a rate approximately one gallon per square foot, a rate approximing that of surface spreading practices. The annual application of 15 tons of dairy manure per acre added approximately 700 lb. N to the soil each year. Even after allowing for estimated crop removal and various losses other than through leaching, a considerable amount of N remained in the soil. Water soluble N accounted for about 160 lb. per acre in the 4 foot accounted for about 160 lb. per acre in the 4 foot profile; it was assumed some moved below that level. The optimum rate of manure application is not substantially greater than that which will supply the maximum nitrogen required by any crop, plus some allowance for losses other than leaching. (See also W72-09940) (Schmitt-Iowa State) W72-10012

MOVEMENT OF POLLUTANT PHOSPHORUS

MOVEMENT OF POLLUTANT PHOSPHORUS IN SATURATED SOILS,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
P. R. Goodrich, and E. J. Monke.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 325-328, 8 fig, 8 ref.

### Group 5B-Sources of Pollution

Descriptors: "Farm wastes, "Fertilizers, "Phosphorus, Nutrient removal, Phosphorus radioisotopes, Sprinkler irrigation, Leaching, Clay loam, Path of pollutants, Saturated soils.

The irrigation of animal wastes containing high concentrations of phosphate onto the soil was simulated. Two different soils and three concentrations of radioactive phosphate were used to dynamically trace the pollutant movement in saturated soil. The sandy loam with its higher clay content absorbed up to four times as much phosphate as did the sand used in this study. Soils do have a limited capacity to adsorb phosphate from solution. While this fact can be safely ignored with normal applications of phosphorus fertilizers, it must be determined and considered in the design of disposal fields for wastes where phosphorus concentrations can be quite high. The rate of absorption may be slower than implied by most literature references because the soil mass at any depth is unlikely to react quickly in total to the phosphorus influx. This was more true for the finer textured soils than for the coarser ones. Although the finer textured soils adsorbed more total phosphorus, the phosphorus front still reached depths much quicker than if the soil behind the front had been totally reactive. The linearized diffusion equation also predicted a much sharper adsorption front than was observed with the two soils tested. (See also W72-09940) (Schmitt-Iowa State)

TREATMENT OF LIVESTOCK-LAGOON EF-FLUENT BY SOIL FILTRATION, Iowa State Univ., Ames. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-10033

3,4-BENZPYRENE IN AQUEOUS SYSTEMS, World Health Organization, Copenhagen (Denmark). Regional Office for Europe. M. J. Suess. Environmental Letters, Vol. 2, No. 3, p 131-133, 1971. 4 ref.

Descriptors: \*Aquatic environment, Organic compounds, Analytical techniques, Adsorption, Membrane processes, Calcite, Sorption, Water pollution.

Identifiers: \*Benzpyrene, \*3,4-Benzpyrene,

Identifiers: \*Benzpyrene, \*3,4-Benzpyrene, \*Polynuclear aromatic hydrocarbons, \*Photochemical degradation, Aqueous systems.

The objectives were to examine membrane filtration as a concentration technique to facilitate 3,4 benzpyrene (BP) analysis, to study the sorption of BP onto mineral surfaces, especially calcite, and to study the rate of photochemical degradation of BP sorbed onto calcite suspended in water as affected by such variables as oxygen concentration, temperature, pH, and light intensity. Synthetic polyelectrolyte membranes were used in an attempt to concentrate BP by reverse osmosis from aqueous solutions containing 20% acetone added to solubilize the BP, whose initial concentrations were 0.1-0.5 mg/1. Instead of concentrating in the solution above the membrane, the BP adsorbed quantitatively onto the latter and was recovered by acetone extraction. Using white fluorescent light actions extraction. Using white intolescent ight the photochemical degradation of BP adsorbed onto calcite suspended in water followed a first order rate equation with respect to BP surface concentration, the initial adsorbed amounts varying from 0.08 to 1.3 microg/g. The degradation was not affected by varying the pH in the range of 7-10, nor ionic strength up to 0.008. The degradation rate constant increased with temperature over the range of 5-31 C, leading to a calculated activation energy of 15.4 kcal/mole. Mineral surfaces may be important vehicles for the transmission of the relatively insoluble BP through environmental waters. Such environmental factors as temperature, oxygen concentration, and, most important, light in-tensity will affect its stability. (Svensson-WashingW72-10057

CONCENTRATION OF BUNKER C FUEL OIL
IN THE WATERS OF CHEDABUCTO BAY,
APRIL 1971,
Bedford Inst., Dartmouth (Nova Scotia).
D. C. Gordon, Jr., and P. A. Michalik.

D. C. Gordon, Jr., and P. A. Michalik.

Journal of the Fisheries Research Board of
Canada, Vol. 28, No. 12, p 1912-1914, 1971. 1 fig, 1

Descriptors: \*Oil pollution, \*Oily water, Water pollution effects, Water pollution, Oil spills, Water pollution sources.
Identifiers: \*Bunker oil, \*Nova Scotia, \*Chedabucto Bay.

The concentrations of bunker C fuel oil in the waters of Chedabucto Bay in April 1971, 19 months after the Arrow disaster, were uniformly low, averaging 1.5 microgram (ppb). Comparison with other data indicates that concentrations in the bay have dropped more than an order of magnitude in the last year and now are at a level that is typical for the concentration of petroleum residues in the marine waters off Atlantic Canada. Although practically all of the Bunker C originating from the Arrow appears to be gone from the water column, oil coverage is still extensive in some inshore areas and considerable quantities of sedimented oil are probably present in the sediments of the bay. (LeGore-Washington)

CONCENTRATION AND DISTRIBUTION OF OIL POLLUTANTS IN HALIFAX HARBOUR, 10 JUNE TO 20 AUGUST, 1971, Fisheries Research Board of Canada, Dartmouth, Nova Scotia. P. A. Michalik, and D. C. Gordon, Jr. Technical Report No. 284, 1971. 25 p, 1 fig, 3 tab, 4 ref. 1 app.

Descriptors: "Oil pollution, "Oily water, Water pollution effects, Water pollution, Water pollution sources, Canada, On-site data collections, Oil wates.
Identifiers: "Halifax Harbour.

Oil pollution has been visibly apparent in Halifax Harbor for many years and is presumably the combined result of ships releasing oily wastes, refinery accidents, and sewer discharge. As a result of the increasing interest in the amount and sources of oil pollution, a survey of oil concentrations in the Harbor was made over the period of 10 June to 19 August, 1971. Average concentrations at individual stations ranged from 1.9 to 71.7 microgram (ppb) at the surface, and from 0.8 to 2.8 microgram (ppb) at a depth of 5 m. The highest concentrations were in the central portion of the Harbor, especially on the Dartmouth side. (LeGore-Washington) W72-10073

THE INVESTIGATION OF SHIGELLA IN WATER USING A TECHNIQUE OF FILTRATING MEMBRANES ASSOCIATED WITH A SOLID ISTRATI ENRICHING MEDIUM, (IN FRENCH),

National Inst. of Public Health, Budapest (Hungary). For primary bibliographic entry see Field 05A. W72-10096

AIRPHOTO ANALYSIS OF OCEAN OUTFALL DISPERSION,
Oregon State Univ., Corvallis. School of En-

gineering.
For primary bibliographic entry see Field 05A.
W72-10146

SUSPENDED MATTER IN MONTEREY BAY, CALIFORNIA: SOME ASPECTS OF ITS DIS-TRIBUTION AND MINERALOGY, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 02J. W72-10148

KAISER REFRACTORIES ENVIRONMENTAL STUDIES.

Moss Landing Marine Labs., Calif. For primary bibliographic entry see Field 05C. W72-10149

THE DDT PROFILE OF SOME SOUTH TEXAS COASTAL ZONE SEDIMENTS: A STUDY OF THE MECHANISMS OF POLLUTION DISPERSAL AND ACCUMULATION IN NATURE, Texas A and M Univ., College Station. Dept. of Geology.

Environmental Quality Note 05, March 1972. 35 p, 11 fig, 21 ref.

Descriptors: \*Texas, \*Coasts, \*Sedimentation, \*Water pollution, \*Dispersion, DDT, DDE, Aquatic animals, Burrows.
Identifiers: \*Arroyo Colorado subdelta, \*Rio Grande Delta.

The DDT profile in sediment cores from the Arroyo Colorado subdelta of the Rio Grande delta was determined. The mechanisms of DDT dispersal, accumulation and post-depositional modification were defined. Identification and evaluation of DDT sinks were attempted. Sediments in the study area were in two main classes: (1) those affected by long periods of current winnowing, and (2) those deposited in quiescent regimes. DDT and DDE were most abundant in the upper part of the core samples near the sediment water interface and decreased with depth. DDT content increased in the fine-grained (clayey) zones. Burrowing organisms aided in transporting DDT into the substrate as deep as the thousands of year old Pleistocene - Early Holocene layers. (Ensign-PAI) W72-10152

MARINE TRANSPORTATION SYSTEMS OF THE TRANS-ALASKAN PIPELINE SYSTEM. Coast Guard, Washington, D.C.

Available from the National Technical Information Service as PB-206 592, \$3.00 in paper copy, \$0.95 in microfiche. December 15, 1971. 158 p, 38 fig. 73 tab. 11 ref. append.

Descriptors: \*Alaska, \*Transportation, \*Pipelines, \*Environmental effects, \*Oil spills, \*Oil wastes, Accidents, Cleaning. Identifiers: \*Marine transportation systems, \*Trans-Alaskan pipeline system.

The environmental impact of the Trans-Alaska Pipeline System (TAPS), with emphasis on the Marine Transport System, is analyzed. Along with review of the project, description analysis of the existing environment was done to establish baseline data. The existing environment was found to be virtually unblemished and traffic consisted of only coastal fishermen and freighters. Analysis showed that approximately 392 barrels a day may be unintentionally discharged due to the transport of two million barrels of oil per day. Intentional discharge was shown to be 0.00007% of the oil handled. Recommendations for reduction of this pollution potential are: prohibition of intentional discharge; compliance with all Coast Guard preventive regulations; traffic management in ports and on the high seas; and review of vessel operational procedures. (Ensign-PAI) W72-10155

ENVIRONMENTAL CONSTRAINTS AND THE GENERATION OF NUCLEAR ELECTRIC POWER: THE AFTERMATH OF THE COURT DECISION ON CALVERT CLIFFS, PART 1. Congress, Washington, D.C., and; Committee on Interior and Insular Affairs (U.S. Senate). For primary bibliographic entry see Field 06E. W72-10168

ENVIRONMENTAL CONSTRAINTS AND THE GENERATION OF NUCLEAR ELECTRIC POWER: THE AFTERMATH OF THE COURT DECISION ON CALVERT CLIFFS, PART 2. Congress, Washington, D.C.; and Committee on Interior and Insular Affairs, (U.S. Senate). For primary bibliographic entry see Field 06E. W72-10169

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PORT AND HARBOR SAFETY.

Committee on Merchant Marine and Fisheries
(U.S. House). Subcommittee on Coast Guard,
Coast and Geodetic Survey, and Navigation.

For primary bibliographic entry see Field 06E.

COASTAL ZONE MANAGEMENT. Committee on Public Works (U. S. Senate). Sub-committee on Flood Control - Rivers and Harbors. For primary bibliographic entry see Field 06E. W72-10194

BRITISH ISLES COASTAL WATERS: THE CONCENTRATIONS OF SELECTED HEAVY METALS IN SEA WATER, SUSPENDED MATTER AND BIOLOGICAL INDICATORS—A PILOT SURVEY, Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.

A. Preston, D. F. Jefferies, J. W. R. Dutton, B. R. Harvey, and A. K. Steele. Environmental Pollution, Vol. 3, p 69-82, 1972. 2 fig, 10 tab, 5 ref.

Descriptors: \*Water analysis, \*Water pollution sources, \*Sea water, \*Metals, Iron, Copper, Manganese, Zinc, Nickel, Cadmium, Lead, Water chemistry, Bioindicators, Aquatic environment, Trace elements, Surveys.
Identifiers: \*Trace metals, Silver, Atomic absorption anaeticable comment.

tion spectrophotometry.

Data from British Isles coastal waters on the concentrations of selected metals in sea water and biological indicators have been obtained by analytical techniques based on atomic absorption spectrophotometry. The results show that there are some areas where significant contamination exists, and the east Irish Sea appears to have the highest concentrations of most metals. However, data in most regions indicate that the concentrations of the metals examined are not significantly higher than those in the onen Atlantic Ocean adtions of the metals examined are not significantly higher than those in the open Atlantic Ocean adjacent to the British Isles. The sampling of seaweeds strongly suggests that concentrations of most metals, including those in polluted areas, have changed little over the ten years up to 1970; the concentrations of cadmium may well, on the average, have fallen over this period. In the Irish Sea, where the most detailed examination has been made, there is a rapid decrease in sea water. been made, there is a rapid decrease in sea water concentrations from the shoreline to offshore, and, in general, the proportions of a metal associated with suspended matter remain fairly constant with respect to variations of total concentrations in either time or space. (Svensson-Washington) W72-10197

A CONVENIENT METHOD OF ANALYSIS OF HUMIC ACID IN FRESH WATER, University of South Florida, Tampa. Dept. of Chemistry; and University of South Florida, St. Petersburg, Marine Science Inst. For primary bibliographic entry see Field 05A.

CHLORAMINE TOXICITY TO THE AM-PHIPOD GAMMARUS PSEUDOLIMNAEUS AND THE FATHEAD MINNOW (PIMEPHALES PROMELAS), National Water Quality Lab., Duluth, Minn. For primary bibliographic entry see Field 05C. W72-10202

STUDIES ON THE EFFECT ON THE BODY AND MIND OF ENVIRONMENTAL CONDITIONS: I. PRELIMINARY SURVEY OF NITRATE INFANT METHEMOGLOBINEMIA AND OF THE NITRATE CONCENTRATION OF THE WATER (IN JAPANESE), Hokkaido Inst. of Public Health, Sapporo (Japan). For-primary bibliographic entry see Field 05C. W72-10232

ACID RAIN, Cornell Univ., Ithaca, N.Y. Section on Ecology and Systems.
G. E. Likens, F. H. Borman, and N. M. Johnson.
Environment Vol 14, No 2, p 33-40, March 1972. 2
fig, 1 tab, 34 ref. OWRR A-029-NY (1).

Descriptors: \*Acidic water, \*Atmosphere, \*Rain-Fall, "Water pollution sources, "Air pollution, Industrial wastes, Fossil fuels, Sulfides, Smoke, Water pollution effects, Corrosion, Environmental effects, Weathering, Ecology, Ecosystems, Chemical reactions.

Identifiers: Fossil fuel emissions.

European scientists have found that rain in northwestern Europe shows a trend toward increased acidity, particularly over the past fifteen years. The tendency appears linked to mounting levels of certain gaseous pollutants such as sulfur and nitrogen oxides, which can be converted chemically in the atmosphere to strong acids. Although the trend appears to pose no apparent threat to health, it can do considerable damage to threat to health, it can do considerable damage to man-made structures and equipment, and more importantly it has serious implications for ecologi-cal systems. Data indicating this trend are ex-pressed in pH values. By burning fossil fuels, man releases large quantities of sulfur and nitrogen ox-ides to the atmosphere. These compounds are in addition to naturally occurring gaseous forms of sulfur and nitrogen. About 3,740,000 tons of sulfur are released to the atmosphere each year by the combustion of fossil fuels. If these acids are not neutralized by alkaline substances also present in the atmosphere, they will ultimately fall to the land and waters in precipitation. Acid rain is not a new phenomenon although it may now be affecting large geographic regions. (Woodard-USGS) W72-10261

A STATISTICAL METHODOLOGY FOR PRE-DICTING THE POLLUTANTS IN A RIVER, Mississippi State Univ., State College. A. Abouel Nour, and A. Razek. Water Resources Bulletin, Vol 8, No 1, p 15-23, February 1972. 2 fig, 3 tab, 6 ref. OWRR A-039-MISS (2).

Descriptors: \*Statistical models, \*Water pollution, \*Path of pollutants, Mathematical models, Regression analysis, Water pollution sources, Water pollution effects. Identifiers: \*Pearl River (Miss).

Accurate, reliable, and sensitive water quality pre diction models may be constructed by dividing a natural stream into independent reaches based on physical criteria. Predicting equations of the water physical criteria. Predicting equations of the water pollutants are obtained by regression in a selected stream. Water quality data were gathered in the Pearl River, which flows southwest and then turns south through the states of Mississippi and Louisians. This evaluation serves as guidelines to divide the total river basin into reaches (subsystems). After subsystem assignment, a step-size multiple researches. PCATEAN recorns is (subsystems). After subsystem assignment, a step-wise multiple regression FORTRAN program is used to regress the pollutants (dependent varia-bles) for both time and space on their water characteristics (independent variables). The statistical approach provides a practical tool for developing regression equations for water pollu-tion prediction. (Knapp-USGS) W72.1076

THREE-DIMENSIONAL BRANCHING-TYPE MODELS OF FLOW THROUGH POROUS MODELS OF MEDIA, Illinois Univ., Urbana. Dept. of Civil Engineering. For primary bibliographic entry see Field 02F. W72-10272

ACCOUNTING FOR APPARATUS-INDUCED DISPERSION IN ANALYSES OF MISCIBLE DISPLACEMENT EXPERIMENTS, Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 02F.
W72-10275

CHEMISTRY AND OCCURRENCE OF CADMI-UM AND ZINC IN SURFACE WATER AND GROUNDWATER, Geological Survey, Menlo Park, Calif. Water Resources Div. For primary bibliographic entry see Field 02K. W72-10277

LONGITUDINAL DISPERSION IN NONU-NIFORM FLOW, Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
H. H. Carter, and A. Okubo.
Water Resources Research, Vol 8, No 3, p 648-660, June 1972. 11 fig. 5 tab, 12 ref. ONR Contract N000 14-67-A-0163-0006.

Descriptors: \*Dispersion, \*Path of pollutants, \*Mathematical models, \*Non-uniform flow, \*Estuaries, Unsteady flow, Mixing, Diffusion, Turbulence, Numerical analysis, Channel morphology, Chesapeake Bay, Maryland. Identifiers: \*Patuxent River (Md).

In nonuniform flow, the velocity at any given time changes from point to point along a streamline. Such a flow occurs in estuaries in which the cross-sectional area increases downstream. A general sectional area increases downstream. A general solution to the one-dimensional equation that describes the fate of a pollutant introduced into such an estuary does not exist; only special solutions exist for various simple analytical expressions for the longitudinal variation of area and longitudinal dispersion coefficient. Furthermore solutions to this equation of the longitudinal dispersion coefficient. gitudinal dispersion coefficient. Furthermore solu-tions to this equation are in terms of the longitu-dinal dispersion coefficient, the value of which is not determinable a priori. A peak concentration model is applicable to estuaries and rivers whose lengths are large in comparison to their widths and depths. This model permits the estimation of the longitudinal dispersion coefficient from the geometry of the system and from measurements of the peak dye concentration determined by the release of a known quantity of a tracer material the peak dye concentration determined by the release of a known quantity of a tracer material such as rhodamine WT. The geometry need not be specified analytically; it need be specified only numerically at the positions of the peak concentration. The tracer experiments and the manner in which the longitudinal dispersion coefficients are estimated are described. A method for estimating the applicability of the procedure is also presented. (Knapp-USGS)

POPULATION DYNAMICS OF BENTHIC CHIRONOMIDAE (DIPTERA) IN SUPRASL RIVER, Bialystok Medical Academy (Poland). E. Neidzwiecki. Pol Arch Hydrobiol. Vol 17 No 4 p 495-508. 1970.

Illus.

Identifiers: \*Chironomidae, Diptera, Peaks, Poland, \*Population, Seasonal, Sewage, \*Suprasl River.

The species composition and the number of occur-rence of benthic Chironomidae species were in-vestigated on 2 sections of Suprasl River. Forty-four Chironomidae spp. were found. In autumn the numbers were several times greater than in the

### Group 5B-Sources of Pollution

other seasons; the larvae number was greatest in the place where the organic sewage waters flow in. Species domination as well as maximal numbers depending on the kind of substrate were investigated .-- Copyright 1972, Biological Abstracts, W72-10311

RECYCLING AND ECOSYSTEM RESPONSE.

Michigan State Univ., East Lansing. Inst. of Water For primary bibliographic entry see Field 06G.

WATER POLLUTION IN LAKE MICHIGAN BY TRACE ELEMENTS FROM POLLUTION AEROSOL FALLOUT, Michigan Univ., Ann Arbor.
J. W. Winchester, and G. D. Nifong.

Water, Air, and Soil Pollution, Vol 1, No 1, p 50-64, November 1971. 1 fig, 10 tab, 25 ref. Contract No. USAEC AT (11-1)-1705.

Descriptors: "Water pollution sources, "Lake Michigan, "Trace elements, "Industrial wastes, "Fallout, Air pollution, Path of pollutants, Copper, Zinc, Nickel, Winds, Aerosols.

Trace elements which are strongly associated with air pollution sources in the Lake Michigan basin may be contributing significantly to lake water pol-lution by an atmospheric fallout route. A partial inventory of air pollution emissions for 30 trace eleents in the Chicago, Milwaukee, and northwest Indiana metropolitan areas is based on available published information. The inventory is compared with actual stream inputs measured for Zn. Cu. and Ni and with estimates of pre-industrial unpolluted stream inputs for 28 elements. The atmosphere may now be a major source of Zn in Lake Michigan, and atmospheric inputs of Cu and Ni may also be considerable. Moreover, air polluwith may also be considerable. Moreover, air pollution probably exceeds expected unpolluted stream inputs for many additional elements in Lake Michigan, highlighting the need for more comprehensive chemical data to quantify the evaluation. (Knapp-USGS) W72-10329

REMOTE SENSING OF THE ENVIRONMENT AND ECOLOGY OF DEVELOPING COUN-

Smithsonian Institution, Washington, D.C. Ecology Program.
For primary bibliographic entry see Field 07B.

W72-10335

STORM WATER RUNOFF FROM AN URBAN HIGHWAY DRAINAGE SYSTEM,

District of Columbia Dept. of Highways and Traf-fic, Washington. Materials Development and Research Div For primary bibliographic entry see Field 04C.

DISTRIBUTION OF HEAVY METALS IN THE SEVERN.

Bristol Univ. (England). School of Chemistry. J. Butterworth, P. Lester, and G. Nickless.

Marine Pollution Bulletin, Vol 3, No 5, p 72-74, May 1972. 1 fig. 4 tab, 12 ref.

Descriptors: \*Path of pollutants, \*Heavy metals, \*Estuaries, Sampling, Water pollution sources, Industrial wastes, Bottom sediments. Identifiers: \*Severn Estuary (England).

Heavy metal pollution was surveyed in the Bristol Channel and Severn Estuary and on land around Bristol, England. Concentrations of zinc, cadmium and lead in water, sediments, seaweeds an shore animals were recorded from a number of sites on the southern shore of the estuary. Con-tamination is detectable 90 miles downstream of Avonmounth, where the highest concentrations of these heavy metals are found. (Knapp-USGS) W72-10345

PREDICTING DISTURBANCES TO THE NEAR AND OFFSHORE SEDIMENTARY REGIME FROM MARINE MINING,

National Oceanic and Atmospheric Agency, Tibu-ron, Calif. Marine Minerals Technology Center.

W. C. Ebersole.
Water, Air, and Soil Pollution, Vol 1, No 1, p 72-88, November 1971. 4 fig, 41 ref.

Descriptors: \*Water pollution control, \*Mining, \*Continental shelf, \*Sedimentation, Excavation, Dredging, Marine geology, Path of pollutants. Identifiers: \*Marine mining.

The major natural forces that will have to be contended with in the course of marine mining opera-tions are defined for both the nearshore and the offshore zones. In order for marine mining to be non-destructive, natural baselines have to be established. To insure that the disturbances established. To insure that the disturbances wrought by mining are minimal, monitoring of the actual operation will be necessary. The tools and techniques for effectively dealing with these problems are discussed and a pilot program of investigations is suggested. (Knapp-USGS) W72-10352

DETECTING TASTE AND ODOR IN DRINKING

WATER,
Drexel Univ., Philadelphia, Pa. Dept. of Chemistry; and Drexel Univ., Philadelphia, Pa. Dept. of Biology.

For primar W72-10372 rimary bibliographic entry see Field 05F.

CROSS-CONNECTION CONTROL AT LOS AN-

Los Angeles Dept. of Water and Power, Calif. For primary bibliographic entry see Field 05F. W72-10373

ARSENIC AND WATER POLLUTION HAZARD, Soap and Detergent Association, New York.

Science, Vol 170, November 20, 1970, p 870. 2 ref.

Descriptors: \*Arsenic compounds, \*Laundering, \*Detergents, Domestic wastes, Toxicity, Public health, Pesticides, Water treatment, Waste water treatment, Water quality control.

Despite earlier investigations which suggested that arsenic in trace amounts in detergents may be capable of producing far-reaching public health hazards, arsenic is, in fact, found in trace amounts in most plants and animals. Arsenic in detergents is introduced in trace amounts up to a maximum of 70 to 80 ppm, whereas arsenic levels found in prawns, shrimp, and bass have been as high as prawns, sarimp, and bass nave ocea as high as 174, 42, and 40 ppm respectively. Arsenic used in detergents exists as the pentavalent state, arsenate, rather than the highly toxic trivalent state, arsenite, that is prepared commercially for pesticide use. Previous investigations have indicated that arsenate is: (1) non-toxic in normal concentra-tions; (2) excreted rapidly largely through the kid-neys; (3) a normal food constituent; and (4) possibly responsible for performing some unk-nown physiological function. Moreover, washwaters using compounds containing 80 ppm of ar-senic, the highest level found, would contain less than 0.15 ppm arsenic, about 25% of the average daily intake. Although usage of arsenical pesti-cides by industry and agriculture may constitute a public health hazard, use of laundry products con-taining the harmless arsenate does not. (See also W72-10398) (Lowry-Texas) W72-10397

ARSENIC AND WATER POLLUTION HAZARD, Novo Enzyme Corp., Mamaroneck, N.Y.

I. V. Sollins. Science, Vol 170, November 20, 1970, p 871. 4 ref.

Descriptors: \*Laundering, \*Domestic wastes, \*Enzymes, \*Arsenic compounds, Detergents, Phosphates, Potable water, Public health, Toxicity, Pesticides, Waste water treatment. Identifiers: \*Trace contaminants.

In the manufacture of enzymes for use in laundry detergents, the only arsenic present is that in-troduced as trace contaminants in sodium chloride troduced as trace contaminants in sodium chloride and other common salts used to precipitate the enzymes from the fermentation liquid, and used also as carriers or bulkers. Total arsenic content of Novo Corporation's Alcalase has been established by an independent laboratory as 50 ppb. When mixed with detergent, the mixture contains 0.5 ppb (from the arsenic contribution of the Alcalase alone), and when mixed with water in the wash, arsenic concentration falls to 1 part in 2 x 1012. The greatest amount of the arsenic measured previously by Angino et al. was contributed by the phosphate, not the enzymes. Finally, all of the arsenic present in detergents is of the arsenate, nonpauspinate, not the enzymes. Finany, all of the ar-senic present in detergents is of the arsenate, non-toxic form, and no danger of contamination or tox-icity exists from this form, especially in the minute concentrations found in washwaters. (See also W72-10397) (Lowry-Texas) W72-10398

THE EFFECT OF FARM WASTES ON THE POLLUTION OF NATURAL WATERS, Wisconsin Univ., Madison; and Marathon County Center, Wausau, Wis.

S. A. Witzel, N. E. Minshall, E. McCoy, R. J.

Olsen, and K. T. Crabtree.
Paper No. 69-428 presented at the 1969 Annual Meeting, American Society of Agricultural Engineers at Purdue University, W. Lafayette, Indiana. June 22-25, 1969. 24 p, 2 fig, 4 tab, 14 ref. Project No. OWRR B-004-WIS (12).

Descriptors: \*Farm wastes, \*Groundwater, \*Nutrients, \*Water pollution, Nitrates, Nitrites, Potassium, Phosphorus, Wells, Supplemental irrigation, Fertilizers, Fishkill, Eutrophication. Identifiers: \*Groundwater pollution, Well contamination, Algal growth, Deoxygenation.

Natural surface waters are subject to enrichment with the plant nutrients N, P, and K, and subsurface waters are often subject to pollution with nitrate and nitrite nitrogen. A study was begun in 1963 to determine the sources and amounts of plant nutrient losses from agricultural operations and to locate any health hazards that may result from the disposal of farm animal wastes. Nutrient losses in the base flow of southwestern Wisconsin streams during the period of high winter runoff totaled only 25% as much N and K and 10% as much P as in the surface runoff. Heavy manure applications in the vicinity of farm buildings or large feedlot operations can result in dangerously high nitrate concentrations in farm wells. Heavy supplemental irrigation combined with heavy nitrogen fertilizer application may result in an increase in the nitrates in ground water. Heavy annual appli-cations of manure and/or fertilizer to large land masses which allow more than 13.5 lb. per acre of nitrogen to pass beyond the root zone could raise the groundwater to the toxic level of nitrates, assuming that all the nitrogen reaches the ground-water and that the aquifer is static. (Dorland-Iowa State) W72-10430

### 5C. Effects of Pollution

POLLUTION OF A STREAM IN NEWFOUN-DLAND: EFFECTS ON INVERTEBRATE FAU-

NA, Memorial Univ. of Newfoundland, St. John's. Dept. of Biology.

J. R. Pickayance

Biol Conserv. Vol. 3, No. 4, p. 264-268, 1971. Illus.

Identifiers: Canada, Chironomids, Crustaceans, Wildlife, Insects, \*Invertebrates, Leech, \*New-foundland, Oligochaetes, Planarians, \*Water pol-

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The deterioration of the invertebrate fauna of a stream in St. John's, Newfoundland, is described and discussed. In 1969, 5 sampling stations were selected along the length of the stream. At Station I (farthest upstream) the fauna was approximately in the stream of th normal although it was low in crustaceans, planari-ans, and non-dipterous insects, and high in chironomids. At Station 5 (farthest downstream) the fauna consisted entirely of oligochaetes with a small percentage of chironomids. In 1970 some leeches had become established at Station 5, indicating a slight improvement in the condition of the stream.--Copyright 1972, Biological Abstracts, Inc. W72-09828

ON THE QUESTION OF THE INTRODUCTION OF PURIFIED WASTE WATER IN LAKES, Eidgenoessische Technische Hochschule, Eidgenoessische Technische Hochschu Kastienbaum (Switzerland). Hydrobiology Lab. R. Gaechter.

Schweiz Z Hydrol. Vol 33, No 1, p73-84. 1971. II-

Nus. English summary.

Identifiers: Plant growth, \*Lakes, Stimulation, \*Waste water disposal, \*Water pollution effects.

A comparison between the actual influx of P and the maximum load a lake can tolerate shows that the P run-off from the soil endangers even the large lakes at the foot of the Alps. It is therefore an absolute necessity that the treatment for phosphate removal be introduced not only in wastewater purification plants along the shores of lakes but also in the entire catchment area. Even after phosphate precipitation, municipal waste-water still contains so much P that it can sustain considerable primary production, at least locally. An attempt was made to determine at which depth in the lake the purified wastewater no longer had any direct stimulating effect on plant growth. It was found that growth can most probably be impeded during summer stagnation if the purified wastewater is discharged not on top of the trophogenic layer, but be introduced at a particular depth. This depth is characterized by the fact that only 5% of the surface intensity of the deepest penetrating rays can still be measured. Since exact optical examinations were carried out in relatively few lakes, a correlation was sought between the required stratification depth and transparency by secchi disk. The general values obtained were applied to a hypothetical practical example.—Copy-right 1972, Biological Abstracts, Inc. W72-09836

OBSERVATIONS ON BACTERICIDAL PRO-OBSERVATIONS ON BACTERICIDAL PRO-PERTIES OF DIGESTED SEWAGE SLUDGE, Illinois Univ., Urbana. Dept. of Agronomy. J-A. E. Molina, O. C. Braids, and T. D. Hinesly. Environmental Science and Technology Vol. 6, No. 5, May 1972, p 448-450, 1 fig. 4 tab, 14 ref.

Descriptors: \*Sludge digestion, \*Coliforms, \*Toxicity, Inhibition, Metabolism, Heavy metals, Nutrients, Proteins, Chelation, Waste water treatment, Water pollution effects, Public health.

oratory investigations using Escherichia coli ATCC 11775 and other fecal organisms demonstrated the toxicity of sewage sludge digested in the laboratory to the various microorganisms. Eight distinctive coliform strains taken from a sludge sample were isolated and maintained in lactose broth. Following one transfer, six strains sur-vived reintroduction into autoclaved digested sludge, but two were killed. After several transfers in lactose broth, the sludge was toxic to all the coliform organisms. Further investigations demonstrated that the liquid phase rather than the solid phase of the digested sludge contained the toxic agent. Of a variety of possible toxicity sources, proteins, parasitic relationships, competition for nutrition, and antibiotics were ruled out. As yet, the actual cause of the bactericidal effect of digested sewage sludge has not been determined. (Lowry-Texas) W72-09847

ENVIRONMENTAL LAW--LANDFILL PERMIT REQUIREMENTS--THE CORPS OF EN-GINEERS DOES AN ABOUT FACE (ZABEL V. TABB, 430 F.2D 199 (5TH CIR. 1970)), For primary bibliographic entry see Field 04A. W72-09907

FAUNAL AND ECOLOGICAL OBSERVATIONS ON THE ANIMAL POPULATIONS OF THE KARSTIC SWAMP PIETRA ROSSA (MONFAL-CONE): PART 2. (IN ITALIAN), Padua Univ. (Italy). Istituto di Biologia Anim. G. Marcuzzi, and A. M. Lorenzoni. Vie Milieu Ser C Biol Terr. Vol 21, No 1, p 1-58. 1970. Illus. Maps. English summary.
Identifiers: \*Animal populations, Cladocera,
Copepoda, Fauna, Insects, Italy,
Pietra Rossa, \*Swamps, Vegetation.

The general geographical, geomorpological and vegetational characteristics are described for Pietra Rossa, a karstic, eutrophic swamp of Northern Italy, where zoological collecting was carried out in spring and summer (1943) and in au-tumn (1945). The composition of the limuic communities, both lotic and lenitic was calculated for Entomostraca (Cladocera, Ostracoda and Copepoda) and aquatic insects. There were about 18 spp. of Cladocera, 5 of Ostracoda, 17 of Copepoda, and at least 52 of insects. For each speautoecological characteristics are described. Finally, a comparison is made between the biological conditions present at Pietra Rossa and those of analogous environments, both in Italy and in other European countries. Several species are new for Italy and a still greater number for Venezia Giulia; these species can be considered as stenotopes.--Copyright 1972, Biological Abstracts, W72-09919

NITRILOTRIACETIC ACID: A LITERATURE

SURVEY, Water Pollution Research Lab., Stevenage (En-

gland). For primary bibliographic entry see Field 05B. W72-09926

STATUS OF THE STRIPED BASS, IN THE DELAWARE RIVER, Virginia Inst. of Marine Science, Gloucester Point.

M. E. Chittenden, Jr. Chesapeake Sci. Vol 12 No 3 p 131-136, 1971. Illus. Identifiers: "Bass, "Delaware River, Morone sax-atilis, Spawning, "Water pollution effects.

The Delaware River was historically an important spawning and nursery area for striped bass, par-ticularly in and near tidal fresh water. Collections of fishes throughout the freshwater sections from 1963 to 1966 by techniques that included continuously fishing traps and large and small meshed seines contained no striped bass, and few specimens were collected in rotenone surveys from 1960 to 1962. Gross population of the tidal freshwater area has destroyed its potential as a spawning and nursery area, has resulted in the virtual extirpation of the striped bass from there and upstream waters, and is the probable cause of the decline in abundance of this species in the Delaware River. Major restoration of striped bass vould occur if pollution is decreased so that the tidal freshwater section can resume its former importance as a spawning and nursery area.--Copyright 1972, Biological Abstracts, Inc. W72-09930 CARCINOGENS IN THE SEWAGE PETROLEUM-PROCESSING FACTORIES,

Identifiers: Benzanthrene, \*Carcinogens, Oil, Benzpyrene, Sewage, \*Water pollution, Industrial plants, \*Industrial wastes.

The contamination of the sewage of a petroleum-processing plant by carcinogenic substances was studied. The content of 3,4-benzpyrene (I) was 0.49-292.9 microgram. The concentration of 1,12-benzpyrene (II) was from 13.3 to 351.2 microgram. The inadequate effectiveness of the plant's purification equipment caused a flow of the carcinogenic substances from its sewage into open inland waters. The conentration of I in the bottom deposits was 23.573.8 microgram/fee and that of II using waters. The conentration of 1 in the bottom deposits was 23-5753.8 microgram/kg and that of II reached 7200.0 microgram/kg. Other carcinogenic hydrocarbons found included 1,2-benzanthrene, 12,3,4-dibenzanthrene and similar compounds of the aromatic series.—Copyright 1972, Biological Abstracts.

IMPACT OF FARM ANIMAL PRODUCTION AND PROCESSING ON THE TOTAL ENVIRON-

Ohio State Univ., Columbus. Dept. of Agricultural

Onto State Univ.; Columnia, Columnia, Columnia, C. P. Taiganides, and R. L. Stroshine.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 95-98. 1 fig, 7 tab, 13 ref.

Descriptors: \*Farm wastes, Biochemical oxygen demand, Chemical oxygen demand, Odor, Waste water (Pollution), \*Environmental effects.

Identifiers: \*Animal waste impact, Odor nuisance, Soil oxygen demand.

A long-term study under the auspices of the Agricultural Pollution Control Research Laboratory at Ohio State University will attempt to delineate the full impact of the world farm animal industry, from birth to the point of consumption, whiteness we concent has been been acceptable to the point of consumption. ultimate use, or death by decay, on the quality of the natural environment. The impact from the production of animals on USA farms was determined by using animal population figures from the 1969 U.S. Agricultural Statistics. Depending on the geographic region, various assumptions were made as to the amounts of manure which could reasonably be expected to be discharged into natural water bodies or disposed on land or into air resources. Assumptions on percentage of animals in total confinement, pasture or partial confinement were made to facilitate estimates of water runoff and land disposal. Odor nuisance could only be evaluated in qualitative terms by making as-sumptions on the extent of urbanization at each of sumptions on the extent of urbanization at each of the six geographic regions. A quantitative value for the impact of by-products and wastes from animal industries on the natural environment was obtained using BOD, COD, fertility nutrients, volatile solids, SOD (Soil Oxygen Demand) and physical quantities. An attempt was made to com-pare these values with values from other basic in-dustries, such as car manufacturing and some chemical industries. (See also W72-09940) (Bundy-Iowa State) W72-09965

BOD ANALYSIS OF SWINE WASTE AS AF-

BOD ANALYSIS OF SWINE WASTE AS AF-FECTED BY FEED ADDITIVES, North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering. J. D. Ariail, F. J. Humenik, and G. J. Kriz. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 180-182. 8 fig, 3 ref.

Descriptors: \*Farm wastes, Swine, Biochemical oxygen demand, Copper, Zinc, Sewage, Lagoons, Analytical techniques, Feeds. Identifiers: \*Feed antibiotics.

### Group 5C-Effects of Pollution

The effects of feed antibiotic, copper and zinc concentrations, and sample dilution upon the standard ROD5 analysis for swine wastes were investigated. Analyses were made on swine feces, lagoon influent and lagoon effluent. Antibiotic concentrations in the swine waste were found by modifying the AOAC (1965) microbiological method for the assay of chlortetracycline in animal feeds. The copper and zinc concentrations of digested samples were determined with an atomic absorption spectrophotometer. The amount of each inhibitory substance present in the BOD bot-tle for the various sample dilutions was determined. The amount of metal or antibiotic present was related to the amount of organics. Therefore all BOD dilutions that result in an acceptable oxygen depletion have similar concentrations of organics and inhibitory substances. Recommenda-tions presented for the selection and determination most reliable BOD5 data for animal waste are different from commonly accepted criteria for obtaining the statistically best BOD5 results for domestic and industrial wastewater. The membrane filter technique outlined in Standard Methods for the determination of the fecal streptococcus content of sewage and animal waste is superior to the membrane filter technique utilizing Bacto-KF streptococcus broth. (See also W72-09940) (Bundy-Iowa State) W72-09989

PORCINE ENTEROVIRUS SURVIVAL AND ANAEROBIC SLUDGE DIGESTION,

Illiaois Univ., Urbana. Dept. of Microbiology; and Illinois Univ., Urbana. Dept. of Veterinary Pathology and Hygiene. R. C. Meyer, F. C. Hinds, H. R. Isaacson, and T.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 183-184. 2 fig, 1 tab, 6 ref.

Descriptors: \*Farm wastes, Sludge digestion, Viruses, Swine, Anaerobic digestion

Little information is available on the effect of anaerobic sludge digestion upon viruses. Laboratory anaerobic digesters of 1 liter capacity were set up in duplicate employing sludge obtained from the local municipal sewage treatment plant. The digesters were monitored and upon stabilization after 4 to 5 days, they were seeded with 100 ml. of a virus suspension containing 10 deg PFU/ml. of a swine enterovirus. At time intervals ranging from 1/2 hr. to 12 days 25 ml, samples were withdrawn from each digester and pooled. The presence of infectious virus in the respective samples was determined by the capacity of a 20 ml. volume, upon mined by the capacity of a 20 ml. volume, upon oral administration, to infect 10-14 day old germ-free piglets. Fecal samples were collected from each pig twice a day (A.M. and P.M.) on the 3rd and 4th day post challenge and pooled. Possible in-fection of piglets by the indicator virus was determined by standard virologic procedures employing diploid porcine kidney cell cultures. Virus, when recovered from the piglets was identified by serologic procedures as the test agent. Virus could not be detected or demonstrated by pig challenge after the 4th day in the anaerobic digesters. (See also W72-09940) (Bundy-Iowa State) W72-09990

EFFECT OF MANURE HANDLING SYSTEMS ON PLANT NUTRIENT CYCLING,

Wisconsin Univ., Madison. Dept. of Soil Science. R. F. Hensler, W. H. Erhardt, and L. M. Walsh. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971. p 254-257, 6 tab, 4 fig, 7 ref.

Descriptors: \*Farm wastes, \*Fertilization, \*Crop response, Aeration, Farm lagoons, Nutrients, Cat-

Identifiers: Plant nutrient cycling.

Fresh, fermented (stacked), aerobic liquid and anaerobic liquid cattle manure handling systems were compared with regard to plant nutrient were compared with regard to piant nutrient utilization by corn. In greenhouse studies, dry matter yields and recovery of nitrogen, phosphorus, and potassium were about the same for fresh, fermented, and anserobic liquid systems, but were significantly less for the aerobic liquid system. Total corn yields and recovery of the programment of the contract of the cont liquid system. Total corn yields and recovery of nitrogen and phosphorus were not greatly affected by oat straw and wood shavings bedding rates up to 8%, but at the 16% rate, yields and nitrogen recovery generally were significantly lower. Regardless of the handling method, manure increased corn yields in field studies. Yield increases were greatest for fermented and anaerobic liquid manure applied in the spring. Runoff losses of total nitrogen ranged from 3 to 24 pounds per acre nnually for winter applied manure as com about 3 pounds per acre for non-manured soil and spring-applied manure. The concentration of nutrients in the runoff was greater from the sod compared to the fallow soils and greater for fertilizer compared to manure treatments. (See also W72-09940) (Schmitt-Iowa State) W72-10011

RECYCLING BROILER HOUSE LITTER ON TALL FESCUE PASTURES AT DISPOSAL RATES AND EVIDENCE OF BEEF COWHEALTH PROBLEMS,

Department of Agriculture, Watkinsville, Ga For primary bibliographic entry see Field 05G.

COASTAL INDUSTRIAL DEVELOPMENT. Dow Chemical Co., Freeport, Tex.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p 39-43.

Descriptors: \*Coasts, \*Industries, \*Economic feasibility, Chemical industry, Environment, Ecosystems, Texas.
Identifiers: Coastal region, Industrial develop-

Coastal areas offer the potential for industrial development ranging from huge industrial complexes to tiny catfish farms. Along the Texacoast, for example, the chemical industry has created huge complexes in order to avail itself of particular coastal resources like natural gas, oyster shell, and salt water. Another advantage offered by coastal areas is that they represent some of the most complex ecosystems in existence and thus make ideal areas for evaluating the impact of, say, a new pesticide on the biosphere. For example, Dow Chemical recently undertook a study in a Texas marsh habitat to evaluate the effectiveness of a new insecticide on the salt-marsh mosquito and to determine the persistence of residues resulting from the application. The gross effects of the insecticide on marine and terrestrial fauna normally living in the intensive mosquito-breeding areas also were evaluated. Included in this evaluaareas also were evaluated. Included in this evaluation were many non-target species like birds, fish, crabs, oysters, shrimp, spiders, and insects other than mosquitoes. These studies also helped develop sampling and analytical techniques. (See also W72-10040) (Settle-Wisconsin) W72-10047

THE COASTAL INTERFACE, Bureau of Commercial Fisheries Galveston, Tex. For primary bibliographic entry see Field 04C. W72-10052

A STUDY OF SIXTEEN ELEMENTS IN THE KIDNEY AND GENITAL ORGANS OF LYM-NAEA STAGNALIS L. (THE POND SNAIL), Vrije Universiteit, Amsterdam (netherlands). Dept. of Zoology.

N. Spronk, F. G. Brinkman, R. J. Van Hoek, and D. L. Knook. Comparative Biochemistry and Physiology, Vol. 38A, p 387-405, 1971. 3 fig, 6 tab, 40 ref.

Descriptors: \*Biochemistry, \*Animal physiology, \*Metals, \*Snails, \*Mollusks, Chemical analysis, Aluminum, Bromine, Chlorine, Copper, Gold, Magnesium, Manganese, Molybdenum, Potassium, Sodium, Strontium, Zinc, Neutron activation analysis.

Identifiers: Antimony, Tin, Vanadium, Lymnaea spp., Kidneys, Genital system, Gamma spectrum analysis.

Al, Au, Br, Cl, Cu, K, Mg, Mn, Mo, Na, Sb, Sr, Sn, V, and Zn were demonstrated in parts of the gonadal system of Lymnaea stagnalis. Except for Sr and Al, these elements were also present in the kidney. Several organs were seen to possess a specific elemental composition. Al is present in specific elemental composition. Al is present in large quantities in the eggs, Br in the pars contorta, and Mn in the albumen gland. The egg capsule contains relatively low quantities of Mg and Mn. In the albumen gland Mg was not detectable. This phenomenon is correlated with the galactose-glucose metabolism in this organ. The kidney, eggs, egg capsule, and ovotestis contain low quantities egg capsule, and ovotesus comain for a solution of Mn. The Na/Cl ratio varies per tissue. (Svensson-Washington)

MARINE FOULING ORGANISMS: NATURAL ATTRACTANTS AND REPELLENTS,
City of Hope National Medical Center, Duarte,

J. S. Kittredge.

Available from the National Technical Informa-tion Service as AD-734 106, \$3.00 in paper copy, \$0.95 in microfiche.

Descriptors: \*Repellents, \*Attractants, \*Oil pollu-Descriptors. Vepticals, "On point-tion, Fouling, Crabs, Analytical techniques, Water pollution effects, Mollusks, Bioindicators. Identifiers: "Chemoreception," Marine fouling or-ganisms, "Pheromones, Chemical attractants, Chemical repellents, Crab physiology, Cancer spp., Neurology, Pachygrapsus spp., Aplysia spp.

Marine organisms probably depend primarily on chemoreception for the location of food, sexual partners, and a hospitable environment. Thus any pollution that interrupts this information flow can as effectively deplete a population as a physiologi-cally lethal compound, and probably at much lower concentrations. Chemical characterizations of the sex pheromones of crabs and physiology of their response to these pheromones were studied. A new bioassay for pheromone activity was developed. The effects of oil pollution on chemoreception were studied. A large number of replicates demonstrated that at one dilution the 'pollutant', an undetermined small amount of the water soluble fraction of a crude oil, completely destroys the normal response of crabs to food stimuli. At a lower dilution the ability to respond to the sex pheromone is lost. Attempts to identify natural repellents were futile. (Svensson-Washington) W72-10059

A FIELD TRIAL WITH THE MOLLUSCICIDE FRESCON FOR CONTROL OF LYMNAEA PEREGRA MUELLER, SNAIL HOST OF DIPLOSTOMUM SPATHACEUM (RUDOLPHI), Shell Research Ltd., Sittingbourne (England). N. O. Crossland, A. J. A. Pearson, and M. S. Bennett.

Journal of Fish Biology, Vol. 3, p 297-302, 1971. 1 fig, 4 tab, 7 ref.

Descriptors: \*Chemcontrol, \*Molluscicides, \*Parasitism, \*Fish parasites, Pesticides, Snails, Rainbow trout, Sticklebacks, Application methods, Rates of application, Water pollution sources, Water pollution effects, Pest control, Pesticide toxicity, Fishkill, Lethal limit.

Identifiers: \*Frescon, \*N-tritylmorpholine, Lymnaea spp, Diplostomum spp, Gasterosteus spp, Salmo spp.

Salmo spp.

Larval stages of the parasite Diplostomum spatheccum cause blindness in rainbow trout Salmo gairdneri. The adult parasite is found in the intestine of various species of gulls, and larval stages are found in various species of snails belonging to the genus Lymanea. A field trial was carried out at Lodge Reservoir, Essex, to test the effectiveness of chemical control of the snail L. peregra. The molluscicide Frescon was applied in the first instance to the whole reservoir to give a concentration of 0.025 mg/l or a second treatment only the periphery of the lake was sprayed to a distance of 5 m from the banks to give a concentration of 0.1 mg/l. Laboratory tests indicated that the dose range of 0.01-0.1 mg/l is critical. No L. peregra were found in samples taken 10 days after the second application of Frescon and it is concluded that this snail had been virtually eliminated from the reservoir. No mortality of trout was observed. Some sticklebacks, Gasterosteus aculeatus, were killed, and this may be attributable to uneven distribution of molluscicide near the margin of the reservoir. There were no apparent side effects on aquastic invertebrates or other wildlife. gin of the reservoir. There were no apparent side effects on aquatic invertebrates or other wildlife. Five months after treatment some repopulation of the shoreline by L. peregra was observed, and ap-plications of Frescon may need to be repeated du-ing the season to maintain an effective level of control. However, where snail pests are confined mainly to the margin of such bodies of water, peripheral treatment may be effective and would be relatively inexpensive. (Svensson-Washington) W72-10060

ANOZIA AND SODIUM LOSS ASSOCIATED WITH THE DEATH OF BROOK TROUT AT LOW PH.

Pennsylvania State Univ., University Park. Dept.

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of Biology.
R. K. Packer, and W. A. Dunson.
Comparative Biochemistry and Physiology, V.
41A, p 17-26, 1972. 5 fig, 17 ref. NSF GB 16653.

Descriptors: \*Acid mine water, \*Acid streams, \*Fish physiology, Mine drainage, Acidic water, Liquid wastes, Waste water pollution water pollution sources, Water pollution effects, Brook

Identifiers: \*Anoxia, \*Ionic regulation, \*Acid pol-lution, Salvelinus spp.

Conditions of low pH are encountered in many streams in Pennsylvania and in other areas due to recause of pollution by acid mine drainage. The effects were studied of such low pH environments of the phone of the p on fish. Brook trout exposed to pH 2-3.5 (HCl) showed a considerable decrease in or a complete inhibition of 02 consumption prior to death. Death from anoxia caused by KCN occurred in about the from anoxia caused by KCN occurred in about the same time as death caused by exposure to very low pH (2.0 HCl). At low pH, trout suffered a massive loss of Na prior to death. The rate of net Na loss was inversely related to survival time. A saline medium (150mM NaCl) had a protective effect, prolonging the life of trout at pH 3.25, but not at pH 2.00. The toxicity of H2SO4 (pH 3.25) was less than HCl of the same pH. Acid mine water was less toxic to brook trout than was H2SO4. was less toxic to brook trout than was H2SO4. Despite differences in toxicity os solutions of HCl, H2SO4 and mine acid, survival time can be accurately predicted if the rate of net Na loss is known. The lethal effect of these acids appears to be due to inhibition of 02 uptake and to a large increase in net Na loss. (Svensson-Washington)

THE COMPARISON OF TOTAL MERCURY LEVELS IN RAINBOW TROUT (SALMO GAIRDNER!) FROM AN OLIGOTROPHIC LAKE AND AN EUTROPHIC LAKE,

Michigan State Univ., East Lansing. Inst., of Water Research.

F. M. D'Itri, C. S. Annett, and A. W. Fast.

Research Report (1971) 24 p, 4 fig, 1 tab, 24 ref. OWRR A-051-MICH (2).

Descriptors: "Mercury, "Waste assimilative capacity, Water pollution, Rainbow trout, Oligotrophy, Eutrophication, Water quality, Absorption, Fish physiology.
Identifiers: "Oligotrophic lake water, "Eutrophic lake water, "Mercury levels in fish, Salmo spp.

The total mercury levels of rainbow trout (Salmo gairdneri) taken from an oligotrophic and an eutrophic lime sink lake have been determined by flameless atomic absorption methods. The data show that mercury levels in fish from the oligotrophic lake are significantly higher than those in the fish from the eutrophic lake. The average total mercury concentration in fish from average total mercury concentration in fish from the oligotrophic lake was 0.17 mg/kg, while the average in fish from the eutrophic lake was 0.07 mg/kg. Moreover, since these lakes receive very little land runoff and are located in a remote undeveloped natural area of Michigan, it is assumed that airborne fallout of mercury probably accounts for the mercury levels that were found. (Svensson-Washington)

EFFECT OF TEMPERATURE ON RATE OF PASSAGE OF FOOD THROUGH THE ALIMENTARY CANAL OF THE PLAICE PLEURONECTES PLATESSA L., University Coll. of North Wales, Menai Bridge. Marine Science Labs.

Washington) W72-10063

Journal of Fisheries Biology, Vol. 3, p 433-439, 1971. 3 fig, 8 fig, 31 ref.

Descriptors: \*Fish physiology, X-ray analysis, Digestion, Temperature.

Identifiers: \*Fish metabolism, Pleuronectes spp.

The variation with temperature of the rate of passage of pieces of lugworm Arenicola marina through the gut of the plaice was investigated by means of an X-ray technique using barium sulphate as a contrast medium. Temperatures of 1, 5, 14, and 20 C. 5, 9, 14 and 20 C, were used, and at each of these the time taken for the food mass to be evacuated by the stomach and to reach the rectum was mea sured. Means of these times were plotted against temperature and were found to lie along negative exponential curves. On double logarithmic plots the relationships were linear. (Svensson-Washing-W72-10064

A COMPUTER SIMULATION OF THE EF-FECTS OF SUPERIMPOSED MORTALITY DUE TO POLLUTANTS ON POPULATIONS OF FATHEAD MINNOWS (PIMEPHALES PROMELAS),

Virginia Polytechnic Inst. and State Univ., Blacksburg Dept. of Biology. W. T. Waller, M. L. Dahlberg, R. E. Sparks, and J.

Cairns, Jr.
Journal of the Fisheries Research Board of Canada, Vol. 28, No. 8, p 1107-1112, 1971. 5 fig, 3

Descriptors: \*Computer models, \*Simulation anal-ysis, Water pollution effects, Zinc, Mortality, Lethal limit, Toxicity. Identifiers: \*Simulated environmental effects,

Fathead minnow populations, Pimephales spp.

This computer simulation study tested the effects of 99 levels of proportional mortality on fathead minnow populations, assuming that the parent-progeny relationship is of the form proposed by Rivker. Limited data from two studies on three lakes were available to fit the model and obtain estimates of parameters for fathead minnow populations. Based on these estimates, 25 replications of a 50 generation cycle were simulated under two levels of environmental variability. Arbitrary extinction levels of 5, 100, and 500 females had little effect on the results. Increasing environmental variation lowered the percentage mortality at which population extinctions occurred. In general, the results are compatible with the recommendation of the U.S. Committee on Water Quality Criteria, that the maximum concentration of zinc to which fish could be continuously exposed should not exceed 1/100 the 96 hr TLm (median reduction in the second 1/100 the 96 hr TLm (median tolerance limit)—a concentration that caused a 50% reduction in the mean number of eggs laid per female by fathead minnows in a laboratory study. (Svensson-Washington) W72-10065

TRACE METAL LEVELS IN INTERTIDAL MOLLUSKS OF CALIFORNIA.

Stanford Univ., Pacific Grove, Calif. Hopkins Marine Station.

The Veliger, Vol. 14, No. 4, p. 365-372, 1972. 3 fig, 3 tab, 13 ref.

Descriptors: "Water pollution effects, "Metals, "Shellfish, "California, "Trace elements, Copper, Absorption, Chromium, Manganese, Lead, Clams, Mussels, Snails, Zinc, Cadmium, Public

Claims, Mussers, Shains, Line, Country, Mealth, Toxicity.
Identifiers: \*Trace metals, Silver, Limpets, Acmaea spp., Mytilus spp., Protothaca spp., Tapes spp., Thais spp., Tegula spp.

Determinations of silver, cadmium, chromium, copper, manganese, lead, and zinc were made by atomic absorption spectrophotometry on seven species of Mollusca in the genera Acmaea, Tegula, Thais (gastropods), and Mytilus, Protothaca, and Tapes (bivalves). Eleven regions along the California coast from San Francisco Bay to Los Angeles were included. Separate analyses were performed on shells and soft portions of whole bodies. Highest levels, above 900 ppm lead in bodies of Acmaea digitalis. 570 ppm copper and 1700 ppm Acmaea digitalis, 570 ppm copper and 1700 ppm zinc in bodies of Thais emarginata, have raised the question of causes for these unusual concentrations. (LeGore-Washington) W72-10067

CHLORINATED HYDROCARBON RESIDUES IN SHELLFISH (PELECYPODA) FROM ESTUARIES OF LONG ISLAND, NEW YORK, New York State Dept. of Environmental Conservation, Ronkonkoma.

vation, Konkonkoma.
J. Foehrenbach, G. Mahmood, and D. Sullivan.
Pesticides Monitoring Journal, Vol. 5, No. 3, p
242-247, December 1971. 1 fig, 4 tab, 2 ref. NOAA
14-17-0002-268, 14-17-0002-345, 14-17-0002-455.

Descriptors: "Pesticide residues, "Chlorinated hydrocarbon pesticides, "Water pollution sources, "New York, DDT, DDE, DDD, Organic pesticides, Water pollution effects, Monitoring, Dieldrin, Shellfish. Identifiers: Long Island (New York).

Since October 1968, the New York State Department of Environmental Conservation has collected shellfish from ten estuaries in Long Island. Collections were made on a monthly basis and were examined for chlorinated hydrocarbons. This study covers the period up to July 1970. The residues found were DDT, DDD, DDE, and dieldrin; concentrations were low, the highest being 0.146 mg/kg wet weight. The distribution of residues could at times be correlated with agricultural use or type of community in the watershed surrounding the various stations. (LeGore-Washington) W72-10068

THE COLLECTION AND PRESERVATION OF OPEN OCEAN MARINE ORGANISMS FOR POLLUTANT ANALYSIS. Woods Hole Oceanographic Institution, Mass. G. D. Grice, G. R. Harvey, V. T. Bowen, and R. H. Beathers.

Bulletin of Environmental Contamination and Toxicology, Vol. 7, No. 2/3, p 125-132, 1972. 1 tab, 2 ref. NSF GX 28334.

### Group 5C-Effects of Pollution

Descriptors: \*Sampling, \*Water sampling, Analysis, Water analysis, Analytical techniques, Chlorinated hydrocarbon pesticides, On-site data collections, Quality control, Organic compounds, Oil, Trace elements. Identifiers: Shipboard sampling, Seawater.

Such pollutants as petroleum hydrocarbons, pesticides, and certain trace metals may exist in very low concentrations in open ocean organisms. This, coupled with the fact that any ocean-going vessel is an abundant source of these same materials, makes the collection of uncontaminated samples for pollutant analysis very difficult. A program to examine present levels of concentration of a variety of pollutants in samples from the open Atlantic Ocean has been undertaken. This program now specifically includes chlorinated hydrocarbons, petroleum residues and some toxic elements in a wide variety of organisms collected at many different stations and depths, and in sediments. The sources of contamination that beset sampling for such purposes, and the procedures adopted to avoid contamination are described. Some data confirming that the procedures described are suc-cessful solutions to the problems posed are presented. (LeGore-Washington) W72-10069

KINETICS OF THE DIRECT UPTAKE OF CA AND SR IONS FROM WATER BY FRESH-WATER GASTROPODS, INFLUENCE OF TEM-

PERATURE, Centre d'Etude de l'Energie Nucleaire, Mol

(Belgium). Laboratoires.
O. Van der Borght, and S. Van Puymbroeck.

Descriptors: \*Absorption, \*Strontium, \*Calcium, \*Animal physiology, \*Physiological ecology, \*Animal physiology, \*Physiological ecology, Biochemistry, Trace elements, Mode of action, Path of pollutants, Water temperature.

Direct uptake of ionic calcium and strontium from the water occurs in some freshwater snails. Temperature influences principally the influx rates, whereas outflux is less affected by changes in temperature. The increase of influx rate with increasing temperature does not follow the Arrhenius law and therefore does not correspond with a simple enzymatic process. Existence of at least two Caexchanging compartments in the animals is suggested by compartmental analysis of Ca-45 absorption and by the exchange of Ca in Ca-45 loaded animals when they are submitted to a sud-den decrease in temperature. Between the experimental limits (6-30 C), the 'observed ratio' for the perature, and varies between 0.3 and 0.6. (LeGore-Washington)
W72-10070

THE EFFECTS OF SILT AND SAND ON THE INVERTEBRATE FAUNA OF STREAMS AND

Council for Scientific and Industrial Research, Grahamstown (South Africa).

F. M. Chutter. Hydrobiologia, Vol. 34, No. 1, p 57-76, September 1969. 1 fig, 4 tab, 20 ref.

Descriptors: \*Silting, \*Biological communities, Sedimentation, Water pollution effects, Water pollution sources, Wildlife, Streambeds, Rivers, Water pollution, Benthos, Benthic fauna.

Most of the literature concerned with the effects of silt and sand on the invertebrate fauna of streams and rivers has described changes taking place when biotopes are completely smothered silt and sand. In few of these studies were the kinds of animals found recorded. There have been few studies of the effect of silt and sand on individual species. The invertebrate fauna of two biotopes in the streams and rivers of the Vaal River system, South Africa, changed with the amount of silt and sand in the watercourses. There may be considerable changes in the current fauna due to silt and sand without the biotope being smothered, and increases in the amount of silt and sand in river beds lead to increased instability of the sediments, which adversely affects their fauna. (LeGore-Washington) W72-10071

CONCENTRATION AND DISTRIBUTION OF OIL POLLUTANTS IN HALIFAX HARBOUR, 10 JUNE TO 20 AUGUST, 1971,

Fisheries Research Board of Canada, Dartmouth, Nova Scotia For primary bibliographic entry see Field 05B.

THE DISTRIBUTION OF ZINC IN THE OYSTER OSTREA EDULIS AND ITS RELATION TO ENZYMATIC ACTIVITY AND TO OTHER METALS

Institute of Marine Biochemistry, Aberdeen (Scotland)

T. L. Coombs.

W72-10073

Marine Biology, Vol. 12, No. 2, p 170-178, January 1972. 2 fig, 4 tab, 52 ref.

Descriptors: \*Animal physiology, \*Oysters, \*Zinc, Shellfish, Zinc, Copper, Calcium, Magnesium, Sodium, Potassium, Phosphate, Absorption, Water pollution effects.

Identifiers: \*Ostrea edulis, \*Oyster enzymes, Car-bonic anhydrase, Alkaline phosphatase, Carboxypeptidase A, Malic dehydrogenase, Alpha-D-mannosidase, Mannosidase.

The role of zinc in the oyster Ostrea edulis has been studied in its relation to the zinc-dependent enzymes present and in relation to the copper, calcium, magnesium, sodium, potassium and phosphate contents. Only carbonic anhydrase, alkaline phosphatase, carboxypeptidase A and malic dehydrogenase zinc metalloenzyme activities could be detected. Alpha-D-mannosidase, a zinc dependent enzyme hitherto not reported in the ovster, was also detected. After tissue dissection into muscle, palps, gills, mantle and digestive mass, and subcellular fractionation of these tissues, analysis indicated that no single tissue concentrates zinc or the zinc dependent enzymes. The total amount of zinc found is far in excess of the amount of zinc contributed by the zinc dependent enzymes, but the amount of non-dialysable zinc is of the same order of magnitude. This apparent excess of dialysable zinc is a consequence of the high levels of calcium found in the tissues, demonstrating a competition between calcium and zinc in their uptake, as is well documented in many other phyla. (LeGore-Washington) W72-10074

TOXICITIES OF ALDRIN AND DIELDRIN TO THE FRESHWATER OSTRACOD CHLA-

MYDOTHECA ARCUATA,
South Dakota Univ., Vermillion. Dept. of Biology.
J. A. Kawatski, and J. C. Schmulbach. Journal of Economic Entomology, Vol. 64, No. 5, p 1082-1085, 1971. 3 tab, 15 ref. OWRR A-015-S DAK (4).

Descriptors: \*Aldrin, \*Dieldrin, \*Pesticide toxicity, \*Food webs, Pesticide residues, and Chlorinated hydrocarbon pesticides, Food chains, Toxicity, Aquatic life, Aquatic environment. Identifiers: Ostracods, Chlamydotheca spp.

Acute toxicities of various mixtures of aldrin and dieldrin against laboratory-reared, insecticide free ostracods were determined. The 24-hr immobility EC-50 values were 1.15 and 2.45 micrograms per liter for aldrin and dieldrin, respectively. Death al-ways followed immobility. Bioassay results from using combinations of aldrin and dieldrin demonstrated no synergism or potentiation with respect to the two insecticides. Ostracods which were laboratory-reared in the presence of insecticide were also tested to determine if increased resistance or sensitivity to the chemicals had occurred by virtue of chronic exposure. Sublethal

exposure to either insecticide through several generations produced populations which were more susceptible to both insecticides. Aldrin was out twice as toxic as was dieldrin. (Svensson-

A MICROBIOLOGICAL SURVEY IN LAKE ERIE NEAR CLEVELAND, OHIO, Connecticut Univ., Storrs. Biological Sciences

Copy available from GPO Sup Doc, \$0.50; microfiche from NTIS as PB-210 324, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series, October 1971. 31 p, 14 tab, 12 ref. EPA Program 16020 GDQ 10/71.

Descriptors: \*Lake Erie, \*Potable water, \*Taste, Podor, Surveys, Microbiology, Water treatment,
Phytoplankton, Fungi, Bacteria, Algae.
Identifiers: \*Cleveland (Ohio), Ceratium, Coelosphaerium, Dinobryon, Fragilaria, Pediastrum, Staurastrum, Tabellaria, Mougeotia.

Periodic taste and odor at the Cleveland, Ohio Crown Water Treatment Plant prompted investiga-tion of the role microorganisms play in this problem. Fungi, bacteria, and algae collected near the plant intake were studied during June through August 1971. During the three months of sampling, no vertical distribution pattern was noted in quantitative analysis of the phytoplankton. In June the maximum concentration of phytoplankton was considerably lower than that observed in July and August. Maximum concentration occurred at the surface with 13,674 organisms per liter; similar concentrations were at the 3 and 9 meter depths; lowest concentrations were at the 6 and 12 meter depths. Studies showed that fungi and bacteria played little, if any, role in the problem. A number of algae, reported to induce taste and odor in water, were identified. Whatever the source of these odors, they were not due to benthic or periphyton algae, but could have been associated with the phytoplankton community as the reported 'Lake Erie odor' coincided with phytoplankton increase. The taste and odor producing algae included: Coelosphaerium, Dinobryon, Fragilaria, Pediastrum, Staurastrum, Tabellaria, and Mou-geotia. There was no evidence that benthic organisms played any significant role. (Jones-Wiscon-W72-10076

DIFFUSION MODEL FOR GREEN BAY,

LAKE MICHIGAN, Wisconsin Univ., Madison. Marine Studies W. F. Ahrnsbrak.

Sea Grant Technical Report No. 7 (WIS-SG-71-207), August 1971. 81 p, 31 fig, 6 tab, 34 ref.

Descriptors: \*Water pollution, \*Bays, \*Diffusion, \*Model studies, Seiches, Seasonal, Lake Michigan, Water pollution effects, Freshwater, Computer programs, Mathematical models, Mixing, Effluents, Turbulence. Identifiers: \*Green Bay (Wis), Fox River (Wis).

The effects and relative roles of various circulation features as dispersive mechanisms in Green Bay, Lake Michigan were examined and evaluated. Green Bay, with its long, narrow shape, is particularly amenable to a one-dimensional analysis because pollutants mark the Fox River water entering at its head. Diffusivities calculated on the basis of a mathematical model of seiche-induced and wind-driven circulation agree with those calculated from the concentration gradients of Fox River water, suggesting that high diffusivity values in the Bay's central portion are primarily due to seiche activity. Effective discharge for Fox River effluent into Green Bay takes place near Long Tail Point rather than at the River mouth. A significant portion of pollutants entering Green Bay throug the Fox River are being transported into Lake

Michigan. Time required for the central portion of the Bay to respond to changes in Fox River discharge rate and to changes in pollutant concentration, without changing the discharge of the Fox River are calculated as 400 days. During the winter ice shields the water from wind effects and greatly decreases the effectiveness of turbulence as a dispersive agent. (Jones-Wisconsin) W72-10077

LABORATORY AND FIELD STUDY OF SLICKS PRODUCED BY PLANKTON ORGANISMS, Florida State Univ., Tallahassee. Dept. of Biologi-

A. Collier, and P. B. Ward.

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A. Collier, and F. B. ward. Available from the National Technical Informa-tion Service as AD-489 261, 33.00 in paper copy, \$0.95 in microfiche. Interim Rpt. September 1966. 47 p, 12 fig, 6 tab, 28 ref. Nonr-988 (12).

\*Marine Descriptors: microorganisms, \*Phylogeny, \*Evolution, Plankton, Lipids, Diatoms, Dinoflagellates. Identifiers: \*Fatty acids, Chaetoceros galvestonensis, Cyclotella nana, Glenodinium.

Content and amounts of fatty acids in marine plankton organisms, diatoms Chaetoceros gal-vestonensis and Cyclotella nana, and dinoflagel-late Glenodinium, were determined with possibility of relating them to others equally primitive, by chain lengths and degrees of fatty acid unsaturation. Indentification of the fatty acids was attempted using the mercuric acetate procedure and separation on a silicic acid column with eluents of varying polarities. Logarithm plats of relative re-tention times versus chain lengths and the relative retention time data of Ackman were also used to assist in characterization. Relative weight percentages of fatty acids were calculated. Data collected, both in this and in other reported investigations lead to the conclusion that the diatoms, although definitely of plant-like character (witness the chlorophyll and photosynthesis) are very far down the evolutionary ladder, and are, in fact, only a few stages removed from that protist which must have been a mutual ancestor of both plants and animals, since the diatoms do retain the carbon-20 poly-unsaturated acid, and a very small amount of linoleic and linolenic acids, in addition to the high palmitic acid content. The dinoflagellate appears to be more on the animal side of evolution. (Jones-W72-10078

NITROGEN FIXATION AND HETEROCYSTS IN THE BLUE-GREEN ALGA ANABAENA

Tokyo Univ. (Japan). Ocean Research Inst.

M. Ohmori, and A. Hattori.
Plant and Cell Physiology, Vol. 12, p 961-967, 1971. 5 fig. 2 tab, 12 ref.

Descriptors: \*Nitrogen fixation, \*Cyanophyta, \*Cytological studies, Nitrates, Nitrites, Ammonia, Plant growth, Carbon, Metabolism. Identifiers: \*Heterocysts, \*Anabaena cylindrica.

The site of nitrogen fixation in the blue-green alga Anabaena cylindrica Lemm (Fogg strain) was in-vestigated using N-15 as a tracer. Less than 4% of the total nitrogen fixed during a relatively short period (5 to 15 minutes) was recovered in heterocysts. When estimated on the cellular nitrogen bas, vegetative cells can fix molecular nitrogen at the same rate as do heterocysts. The population which consisted exclusively of vegetative cells could grow in the absence of combined nitrogen.

There was no positive correlation between nitrogen fixation and heterocyst formation. On the hand, the relative number of heterocysts varied during growth, irrespective of the presence or absence of nitrate. Heterocyst formation was apparently correlated with the carbon/nitrogen ratio of cells. Previous work suggested that heterocyst differentiation is initiated when concentration of a specific nitrogenous substance in cells falls

below a critical level, or when that of some substance such as an intermediate in carbon metabolism attains a certain level. Both vegetative cells and heterocysts are capable of fixing molecular nitrogen. Results do not support the hypothesis that the heterocyst is the main site for nitrogen fixation in blue-green algae. (Jones-Wisconsin)

CHARACTERISTICS OF NITROGENASE ACTIVITY IN BROKEN CELL PREPARATIONS OF THE BLUE-GREEN ALGA GLOEOCAPSA

SP. LB 795, National Research Council of Canada, Saskatoon

(Saskatchewan). Prairie Regional Lab. J. R. Gallon, T. A. LaRue, and W. G. W. Kurz. Canadian Journal of Microbiology, Vol. 18, p 327-332, 1972. 2 fig, 6 tab, 18 ref.

Descriptors: \*Enzymes, \*Nitrogen cycle, \*Cyanophyta, Nitrogen fixation, Hydrogen, Proteins, Metabolism, Biochemistry, Azotobacter, Clostridium, Cytological studies. Proteins, Azotoacter, Costribum, Cytological studies.

Adentifiers: \*Gloeocapsa, Chroococcales,
Acetylene reduction, Adenosine triphosphate,
Adenosine diphosphate. Identifiers:

Although filamentous blue-green algae are known to fix nitrogen, only recently has this ability been found in unicellular blue-green algae Gloeocapsa sp. LB 795 and G. alpicola IAM M123. Nitrogenase activity is investigated in broken cell preparations and its properties compared with those from other sources. The nitrogenase found in broken cell preparations of Gloeocapsa sp. LB 795 appears to be very similar in most of its properties to the nitrogenases found in other blue-green algae and in bacteria. In particular, the kinetic constants of Gloeocapsa nitrogenase are remarkably similar to those reported from other sources, and it is particularly interesting that although this organism is phylogenetically distant from the other organisms for which these enzyme constants have been found, the enzyme is similar in almost all respects. The Gloeocapsa enzyme is different from the nitrogenases from the other blue-green algae in that it is particulate and also in that it is as stable at OC as at room temperature. In both these respects it resembles crude preparations of the particulate Azotobacter nitrogenase rather than the soluble Clostridium enzyme or the nitrogenases of Anabaena or Plectonema. (Jones-W72-10081

FRESHWATER ECOLOGY IN THE MATO GROSSO, CENTRAL BRAZIL. II. ASSOCIA-TIONS OF CLADOCERA IN MEANDER LAKES OF THE RIO SUIA MISSU, Westfield Coll., London (England). Dept. of

I. Green.

Journal of Natural History, Vol. 6, p 215-227, 1972. 3 fig, 6 tab, 25 ref.

Descriptors: \*Freshwater, \*Crustaceans, \*Tropical regions, Ecology, Biological communities, Meanders, Lakes, Systematics, Niches.

Identifiers: \*Mato Grosso (Central Brazil, \*Rio Suia Missu (Brazil), Endemicity, Holopedium amazonicum, Bosmina hagmanni.

Five meander lakes in the Rio Suia Missu Valley of Brazil, separated from the main river channel for varying lengths of time, are arranged according to age, size, and depth. All the lakes are shallow. to age, size, and depth. All the lakes are shallow. They were sampled during September to the end of November 1968. All the samples were preserved in 5% formalin and were examined in detail in London. A total of 26 species of Cladocera were identified in the samples and descriptions given. The associations of Cladocera in the youngest and deepest lakes were dominated by planktonic Cladocera, such as Holopedium amazonicum and Bosmina hagmanni. The older and shallower lakes had a greater variety of Cladocera and the associations were dominated by

chydorids and macrothricids. The diversity of spechydonds and macrothricids. The diversity of spe-cies was greatest in the lakes in the middle of the sequence. More species were found in all the lakes than would be expected from MacArthur's broken stick model with non-overlapping niches. The majority of the species (62%) in the samples were cosmotropical, 23% were cosmopolitan, and the reamining 15% were species known only from America. (See also W70-08346 and W72-10083) (Innex-Wisconsin) (Jones-Wisconsin)

FRESHWATER ECOLOGY IN THE MATO GROSSO, CENTRAL BRAZIL. III. ASSOCIA-TIONS OF ROTIFERA IN MEANDER LAKES OF THE RIO SUIA MISSU, Westfield Coll., London (England). Dept. of

Zoology. J. Green.

Journal of Natural History, Vol. 6, p 229-241, 1972. 2 fig, 5 tab, 22 ref.

Descriptors: \*Freshwater, \*Biclogical communities, \*Tropical regions, Ecology, Rotifers, Meanders, Lakes, Systematics.
Identifiers: \*Mato Grosso (Central Brazil), \*Rio

Suia Missu (Brazil).

Rotifera found in five meander lakes in the Rio Suia Missu Valley, Central Brazil were sampled and preserved in formalin. Samples were ex-amined in London and compiled alphabetically by amined in London and compiled alphaeetically by genera and species within each genus. Rotiferan faunas of each lake are summarized as dominant and subsidiary species. Calculations of diversity are based on percentage composition. The lakes are arranged in a size and depth sequence which also seems to be an age sequence. As the hydrosere develops it provides niches for more weed-dwelling species and open-water species gradually disappear thus the rotifer faunas are re-lated to the development of the marginal hydrosere. Associations of rotifers in the youngest and deepest lakes were dominated by Brachionus gessneri. Older and shallower lakes had greater variety including several Lecane and Trichocerca species. Greatest species diversity was found in shallow water of the lake in the middle sequence. More species were found in all the lakes than would be expected from MacArthur's broken stick model with non-overlapping niches. 69% of the species were cosmopolitan, 17% were cosmotropical, and 14% were species known only from the Americas. (See also W70-08346 and W72-10082) (Jones-Wisconsin) W72-10083

INGESTION, ASSIMILATION, SURVIVAL, AND REPRODUCTION BY DAPHNIA PULEX FED SEVEN SPECIES OF BLUE-GREEN AL-Michigan Univ., Ann Arbor. Great Lakes

Research Div. D. E. Arnold

Limnology and Oceanography, Vol. 16, No. 6, p 906-920, 1971. 4 fig, 3 tab, 51 ref.

Descriptors: \*Digestion, \*Reproduction, \*Daphnia, \*Cyanophyta, Metabolism, Foods, Chlorella, Toxicity, Life history studies,

Identifiers: \*Daphnia pulex.

Blue-green algae assimilation by Cladocerans has been questioned. Where zooplankton are unable to feed on the predominant phytoplankton, or where their populations were depressed by previous unsuitable food conditions, grazing could cease to be a factor in controlling phytoplankton thus contributing to nuisance conditions. Anacystis nidu-lans, Synechococcus elongata, S. cedrorum, Merismopedia, Anabaena flos-aquae, Synechocystis, and Gloeocapsa alpicola, and the green algae Ankistrodesmus falcatus and Chlorella vulgaris for comparison, were fed to Daphnia pulex. Food was given in depression slides where the Daphnia could be watched as they fed. C-14 labeled food

### Group 5C-Effects of Pollution

was used to determine ingestion and assimilation. Net reproductive rate, median age at death, sur-vivorship, and intrinsic rate of natural increase were calculated and tabulated in life tables. In all cases these processes were lower in Daphnia fed blue-green algae than in those fed green algae, although the blue-green algal species differed in their effects on these parameters. Anacystis nidulans, Merismopedia, and Synechocystis showed some toxicity or inhibition to D. pulex. Few of the blue-greens tested provide sufficient nutrition to support a D. pulex population that does not have other food available. (Jones-Wisconsin) W72-10084

THE EFFECT OF TEMPERATURE ON THE DEVELOPMENT OF RESTING EGGS OF DIAPTOMUS OREGONENSIS LILLJ (COPEPODA: CALANOIDA).

Toronto Univ. (Ontario). Dept. of Zoology.

Limnology and Oceanography, Vol. 16, No. 6, p 921-926, 1971. 3 fig, 1 tab, 21 ref.

Descriptors: \*Reproduction, \*Copepods, \*Tem-

perature. Identifiers: \*Development, \*Resting eggs, Diaptomus oregonensis, Diapause.

Diapause has been studied in several lake zooplankters. Few studies have been designed specifically to investigate diapause in Calanoida. Diaptomus oregonensis eggs collected from Teapot Lake, Ontario in October 1968 for routine development rate measurements failed to hatch in the expected time. The possibility was studied whether D. oregonensis overwinters as diapausing eggs produced in late fall. It was found that D. oregonensis produces diapausing eggs between October and the time in November when a fall overturn deoxygenates the water and kills all zooplankton. The only visible difference between resting and subitaneous eggs was that the former were reddish-brown and the latter green. Resting eggs incubated in the laboratory at about 4C in October and November will hatch at about the same time the following spring in the laboratory as in Teapot Lake, but they can be induced to hatch sooner at higher temperatures if they have ex-perienced about 3 to 4 weeks at 4C. Diapausing temperature are capable of surviving at warmer temperatures (14C) for extended periods and can subsequently be induced to hatch by exposure to cold. (Jones-Wisconsin)

INFLUENCE OF NITROGEN DEFICIENCY ON LIBIDINE INCORPORATION THE GREEN IN CHLORELLA,

Gottingen Univ. (West Germany). Inst. for Plant Physiology.

V. Ssymank. Archiv fur Mikrobiologie, Vol. 82, p 311-324, 1972. 5 fig, 3 tab, 31 ref.

Descriptors: \*Nitrogen, \*Deficient elements, \*Cytological studies, \*Chlorella, Chlorophyta, Enzymes, Genetics, Amino acids.

Identifiers: \*Uridine, \*Ribosome : Chlorella pyrenoidosa, Ribonucleic acid.

Incorporation of 5-tritiated-uridine is a good means to study RNA synthesis in chloroplasts of Chlorella because in this alga ribosomal particles from chloroplasts are labeled by uridine to a much greater extent than those from the cytoplasm. Nitrogen deficiency drastically diminishes amino acid pools and should thus affect synthesis of chloroplastic or cytoplasmic RNA in different ways. Degree of incorporation of uridine into RNA within 15 minutes is comparable in normal synchronous, nitrogen-deficient, and recovering cultures of Chlorella pyrenoidosa. Kinetics of incorporation of uridine into RNA show the kind of curves expected from the theory for systems with

several products or several compartments. When the cultures are treated with rifampin or chloramphenicol, uridine incorporation is much more inhibited in normal cells than in nitrogen-deficient cells, while treatment with cycloheximide has only slight effects in both cases. In Ndeficient and recovering cultures, tritiated-uridine activity can be shifted by chase treatment from ribosomal precursors to 80S ribosomes (in contrast to normal cultures where it can be shifted to 70S ribosomes). Particles isolated from a membrane rich cell fraction by DOC treatment are labeled much more quickly by tritiated-uridine in N-defi-cient than in normal cells. (Jones-Wisconsin) W72-10086

CHARACTERISTICS OF THE NITROGENASE SYSTEM OF THE BLUE-GREEN ALGA ANABAENA CYLINDRICA, Dundee Univ. (Scotland). Dept. of Biological

Sciences.

A. Haystead, and W. D. P. Stewart. Archiv fur Microbiologie, Vol. 82, p 325-336, 1972. 6 fig, 6 tab, 24 ref.

Descriptors: \*Biochemistry, \*Cyanophyta, \*Enzymes, \*Nitrogen fixation, \*Metabolism, Oxygen, Iron, Cations, Magnesium, Manganese, Cobalt, Inhibitors, Clostridium, Photosynthesis, Respiration, Proteins, Oxidation-reduction potential. Identifiers: \*Nitrogenase activity, \*Anabaena oxidation-descriptions at triphosphate triphosphate in the company of the cylindrica, Adenosine triphosphate.

Preparations from crude extracts of Anabaena cylindrica possess nitrogenase activity. Further information on the enzyme characteristics are presented, particularly on its cation requirement, on the presence of iron and reduced thiol groups at the active site and on the ways in which its solu-bility varies depending on the purity of the preparation. A scheme is presented which shows the possible inter-relations of nitrogen fixation with other metabolic processes. The partially purified enzyme is soluble and specific activities have been obtained; its biochemical characteristics, as determined in studies using enzyme inhibitors, are similar to those of bacterial and legume nitrogenases in that it is a metallo-protein and the redox capacity of the enzyme involves a possible valency change in the iron. The transfer of electrons from H2 via a bacterial hydrogenase has been shown to be mediated, at least in pa ferridoxin. The role of ferridoxin and the interrela tionships between photosynthesis, reductant pool and hydrogen metabolism are discussed in the light of recent results. (Jones-Wisconsin) W72-10087

THE NATURE OF THE PHOTOSYNTHATE IN NATURAL PHYTOPLANKTON POPULATIONS IN RELATION TO LIGHT QUALITY, Simon Fraser Univ., Burnaby (British Columbia).

Dept. of Biological Sciences. D. G. Wallen, and G. H. Geen

Mar Biol. Vol 10, No 2, p 157-168. 1971. Illus. Map. Identifiers: \*Light, \*Photosynthate, \*Phytoplank-

The relative concentrations of a variety of organic compounds in phytoplankton from different depths of the photic zone of Saanich Inlet and Indian Arm, British Columbia, Canada, were determined. In surface phytoplankton the greatest pro-portion of 14C in newly-formed organic compounds was in the ethanol-soluble fraction irrespective of the light intensity. The proportion of the label in the insoluble fraction increased with depth. Within the ethanol-soluble fraction the relative importance of carbohydrates decreased and amino acids increased with depth. Experiments in amino acids increased with depth. Experiments in Indian Arm indicated that these observed changes were in response to light quality rather than intensity. The percentage release of dissolved organic carbon as a percentage of total fixation decreased with depth and was directly related to the size of the ethanol-soluble fraction.—Copyright 1972, Biological Abstracts, Inc.

THE ESTUARY OF THE HUDSON RIVER.

U.S.A., Natural Environment Research Council, London

Natural Environment (England).
G. P. Howells.
Proceedings of the Royal Society of London, B.,
Vol. 180, p 521-534, 1972. 3 fig, 4 tab, 20 ref.

Descriptors: \*Estuaries, \*Hudson River, Ecology, Water quality, Fisheries, Eutrophication, Potable water, Pollutants, Biological communities, Hydrology, Physicochemical properties, Water pollution control, Water demand, Comprehensive planning, Industrial water, Water pollution sources, Water pollution, Research priorities, Management. Identifiers: \*Lower Hudson (N.Y.), \*Hudson

Estuary.

Although each estuary contains unique characteristics, studies of contrasting estuaries build up a body of knowledge defining estuaries as ecosystems and document existing conditions. A comparative approach allows economy of effort and direct attack on problems of management or control. Although the Hudson is a major river, utilized for drinking water, transport, sewerage, and recreation, it has been relatively neglected scien-tifically. Sufficient information is now available on the Lower Hudson to formulate simple models usable for predictive purposes. Information about variety and abundance of flora and fauna is lacking. Water quality control may be needed if problems of fishery maintenance, eutrophication, and drinking water are to be avoided. The processes and pathways of pollutants within this estuarine ecosystem need research and study of effects on biological communities in relation to concentration and time of exposure. Great natural environmental variations exist in estuaries and the flora and fauna are affected by the need to tolerate these variable conditions. Capacity of estuaries to accept pollutants which enhance natural variations is relatively great. The best reconciliation between industrial development and maintenance of ameni-ty needs to be determined. (Jones-Wisconsin) W72-10089

EVIDENCE FOR THE NONESSENTIALITY OF ASCORBIC ACID IN THE DIET OF RAINBOW TROUT, Florida State Univ., Corvallis. Dept. of Food

Science and Technology. E. R. J. Primbs, and R. O. Sinnhuber.

Progr Fish Cult. Vol 33, No 3, p 141-149. 1971. Il-

Identifiers: \*Ascorbic acid, \*Diet, Exophthalmos, Nonessentially, \*Rainbow trout, Scoliosis.

Tests were applied to 11-mo,-old rainbow trout to determine whether ascorbic acid is essentia their diet. Tests showed that the experimental fish were depleted of ascorbic acid significantly below a level of the control trout; however, no effects could be detected upon growth, formation and replacement of collagen, hematological condition. spleen development, fat metabolism, or mortality rate. Specifically, lordosis and scoliosis failed to develop in 11-mo-old-fish. There is evidence that the development of scoliosis and exophthalmus in the 2-mo-old fish is attributable to hypervitaminosis A and not to hypovitaminosis C. It is hypothessix A and not to hypotranninous C. It is appointed that the results of others show that the dietetic requirement of ascorbic acid by the salmonids are caused by an interrelation of ascorbic acid with vitamin A.—Copyright 1972, Biological Abstracts, Inc. W72-10090

PHOTOSYNTHESIS AND RESPIRATION IN MYRIOPHYLLUM SPICATUM L. AS RELATED

TO SALINITY, East Carolina Univ., Greenville. N.C. Dept. of

Biology. C. F. McGahee, and G. J. Davis. Limnology and Oceanography, Vol. 16, No. 5, p 826-829, 1971. 3 fig, 1 tab, 7 ref. Descriptors: \*Aquatic plants, \*Salinity, Estuaries, Photosynthesis, Respiration, North Carolina. Identifiers: \*Myriophyllum spicatum, Albemarle Sound (N.C.).

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Sound (N.C.).

Effects of increasing salinities on photosynthesis and respiration in Myriophyllum spicatum are reported. Vegetative, floating fragments of M. spicatum were collected along the southern shore of Albemarle Sound, North Carolina and maintained three weeks in sound water in an aquarium growth chamber. Tips 2 cm long were removed and placed singly in test tubes in an artificial seawater series or in a series of Albemarle Sound water-artificial salt solutions. Per mil salinities in each group were at 0, 4, 8, 16, and 32. After about 20 hours at low light intensity in the laboratory, photosynthesis was depressed in Myriophyllum spicatum tips at 32 mil salinity but respiration was not affected. Neither photosynthesis nor respiration was depressed at 16 per mil salinities and less. When the plants were maintained on 10-14 hour light-dark cycles at moderate light intensities, after 48 hours and up to 10 days, photosynthesis was depressed at 16 per mil salinities below that of plants in Albemarle Sound water, although respiration remained high. Photosynthesis depression at high salinity and its effect on the photosynthesis:respiration ratio seem influential in controlling natural distribution of M. spicatum in estuaries. (Jones-Wisconsin) W72-10091

STUDIES ON EFFECTS OF CERTAIN QUIN-ONES. II. PHOTOSYNTHETIC INCORPORA-TION OF 14CO2 BY CHLORELLA, Syracuse Univ., Research Corp., N.Y. Life Sciences Div.

G. Zweig, J. Carroll, I. Tamas, and H. C. Sikka. Plant Physiology, Vol. 49, p 385-387, 1972. 2 tab,

Descriptors: \*Pesticides, \*Photosynthesis, \*Carbon dioxide, \*Chlorella, Inhibition, Herbicides, Fungicides, Lipids, Enzymes, Metabolism,

Fungicides, Lipids, Enzymes, Metaboli Chlorophyll. Identifiers: \*Quinones, Chlorella pyrenoidosa.

The effects of quinone herbicides and fungicides on photosynthetic carbon dioxide fixation were investigated in the intact cell of Chlorella pyrenoidosa. Results give effects of quinones not previously reported. Addition of dichlone, 06K-quinone, or chloranii inhibited carbon dioxide fixation, whereas 14 herosynthesis w quinone, or chloranii inhibited carbon dioxide fixation, whereas 1,4-benzoquinone had no effect. Treatment with 3 micromoles or higher concentrations of dichlone, 06K-quinone, or 1,4-benzoquinone also produced marked changes in the pattern of C-14 distribution. A noticeable effect was an increase in the proportion of C-14 in sucrose and glycine accompanied by a reduction in C-14 lipids and glutamic acid. These changes appear to occur as a result of shifts in the flow of carbon along various biosynthetic pathways of photosynthetic carbon dioxide fixation. It is suggested that inactivation of coenzyme A and shortage of reduced triphosphopyridine nucleotide in the quinone-treated cells inhibited the synthesis of lipids and glutamic acid, thereby diverting more carbon insucrose and glycine. The results indicate that quinones included in this study exert a regulatory effect on carbon metabolism. (Jones-Wisconsin) W72-10092 W72-10092

THE FERTILIZATION OF GREAT CENTRAL LAKE. I. EFFECT OF PRIMARY PRODUC-

Fisheries Research Board of Canada, Nanaimo (British Columbia). Biological Station. T. R. Parsons, K. Stephens, and M. Takahashi. Fishery Bulletin, Vol. 70, No. 1, p 13-23, 1972. 11 fig. 18 ref.

Descriptors: "Fertilization, "Primary productivity, "Fish management, Fish populations, Standing crops, Lakes, Trophic level, Secondary productivity, Biological communities, Food chains, Oligotrophy, Sockeye salmon.

Identifiers: \*Great Central Lake (Canada), Species composition.

To increase levels of production in an oligotrophic lake, but not to change the trophic relationships which lead to the production of young sockeye salmon was the primary purpose of this study. Commercial fertilizer was added to Great Central Lake, B.C., (51 sq m, mean depth 200 m) at a rate of five tons per week over a period of five months, from May to October 1970. Surface primary production was increased as a result of these additions approximately tenfold while the primary production of the euphotic zone was doubled. The standing stock of primary producers and water clarity were substantially the same as in the previous year when no fertilizer was added. Especially in the immediate area of nutrient enrichment, the productive index (mgC/mg chlorophyll a/hr) was in the immediate area of nutrient enrichment, the productive index (mgC/mg chlorophyll a/hr) was increased. At locations near and distant from the area of fertilization, the principal phytoplankton species were very similar. It appears that as a result of adding nutrients at a low but sustained level, primary productivity was increased without substantially changing the nature of the food chain at the primary level of production. (See also W72-10094) (Jones-Wisconsin) W72-10094)

THE FERTILIZATION OF GREAT CENTRAL LAKE. II. ZOOPLANKTON STANDING STOCK, Fisheries Research Board of Canada, Nanaimo (British Columbia). Biological Station.
R. J. LeBrasseur, and O. D. Kennedy.
Fishery Bulletin, Vol. 70, No. 1, p 25-36, 1972. 6

fig, 6 tab, 12 ref.

Descriptors: \*Fertilization, \*Zooplankton, \*Fish populations, \*Fish management, Standing crops, Rotifers, Crustaceans, Limiting factors, Copepods, Primary productivity, Distribution, Biomass, Sockeye salmon, Lakes, Secondary productivity, Food chains, Seasonal. Identifiers: \*Great Central Lake (Canada).

The effects of sustained nutrient additions to oligotrophic Great Central Lake, British Columbia, were studied with relation to the standing stock and diversity of secondary producers, especially the available zooplankton biomass, which enhances the sockeye salmon growth. Regional, vertical, and seasonal abundance of the dominant vertical, and seasonal abundance of the dominant zooplankton were analyzed. Two rotifers, three cladocerans and three copepods were the most numerically abundant zooplankton. Introduction of fertilizer and the consequent higher rate of primary production produced no changes in the species composition. A relatively uniform horizontal distribution within the upper 20 meters was exhibited. All eight species were concentrated in the upper 40 meters, and five were most abundant in the upper 40 meters, and five were most abundant in the upper 40 meters. meters, and five were most abundant in the upper 10 m. The remaining three species were concen-trated between 20 and 30 m depth. Little variation was shown between daylight and darkness. There were two seasonal periods of maximum abundance: June to July and September to Oc-tober. The estimated growth rate for underyearling tober. The estimated growth rate for underyearling sockeye salmon was only slightly improved and the growth rates appeared low. The temperature structure of the lake may reduce availability and prevent efficient utilization of zooplankton by the underyearling sockeye salmon. (See also W72-10093) (Jones-Wisconsin) W72-10094

CHANGES IN PIGMENT COMPOSITION AND PHOTOSYNTHESIS INDUCED BY IRON-DEF-ICIENCY IN THE BLUE-GREEN ALGA ANA-CYSTIS NIDULANS.

Umea Univ. (Sweden). Dept. of Biology.

G. Oquist. Physiologia Plantarum, Vol. 25, p 188-191, 1971. 3 fig, 30 ref.

Descriptors: \*Deficient elements, \*Photosynthes-is, \*Iron, \*Cyanophyta, Pigments, Absorption, Chlorophyll, Cytological studies. Identifiers: \*Anacystis nidulans.

It has been known that iron is an essential element in chlorophyll synthesis yet its function is not quite understood. The explanations of iron-chlorosis follow two different paths. One hypothesis is that insufficient iron supply reduced protein synthesis and the development of chloroplasts or lamellar systems are disturbed. Thus, the in vivo association between chlorophyll and structural proteins is disrupted. The second mechanism to explain chlorosis is that iron might be necessary in certain steps of porphyrin synthesis. Living Anacystis, grown in complete and iron-deficient inorganic media, was used for determination of absorption spectra and photosynthetic action spectra. When the algae were grown without iron, a spectral shift from 679 nm to 673 nm was shown in the chlorophyll a absorption peak. The shift is believed to reflect a changed ratio between at least two chlorophyll a forms denoted Ca670 and Ca680 in this work. Action spectra determinations have revealed a similar shift from 677 nm to 672 nm in the photosynthetic activity peak of chlorophyll a manual transport in the photosynthetic activity peak of chlorophyll and the stantistic transport in the photosynthetic activity peak of chlorophyll in the photosynthetic activity peak of chlorophyll and the stantistic transport in the photosynthetic activity peak of chlorophyll and the photosynthetic activity peak of chlorophyll and the protein the photosynthetic activity peak of chlorophyll and the photosynthetic activity peak of chlorophyll and the protein the protein the protein and the photosynthetic activity peak of chlorophyll and the photosynthetic activity peak of chlorophyll and the protein and the photosynthetic activity peak of chlorophyll and the protein and the the photosynthetic activity peak of chlorophyll a when Anacystis was transferred to a medium without iron. It is proposed that both Ca670 and Ca680 participate in light absorption for photosystem I. (Jones-Wisconsin) W72-10095

ASPECTS OF PHOSPHORUS CYCLING IN BRACKISH WATERS, North Carolina Univ., Chapel Hill. Dept. of En-vironmental Sciences and Engineering.

Vitominena.

L. J. Kuenzler.

Available from the National Technical Information Service as ORO 3349-7, \$3.00 in paper copy, \$0.95 in microfiche. April 1971. 50 p, 8 fig. 4 tab, 60

Descriptors: \*Cycling nutrients, \*Phosphorus, \*Brackish water, \*Estuaries, Social needs, Eutrophication, Water pollution effects, Oxidation lagoons, Limiting factors, Water purification.

The possibility that small brackish-water ecosystems can 'self-design' when subjected to domestic sewage was investigated. Six ponds, three receiving municipal sewage wastes, were regulated with seawater and tapwater or seawater and treated sewage to control salinities and retention time. They were seeded by larvae and micro-scopic plants and animals and also by freshly caught fish and macroinvertebrates. In essence, caught tish and macroinverteerates. In essence, the polluted ponds are 'tertiary treatment' or 'oxidation' ponds. Measurements were conducted for two years of temperature, salinity, insolation, plant nutrients, and standing crops. Metabolic rates were assessed. It is possible that relatively small, brackish oxidation ponds may help prevent deterioration of the quality of the receiving water; organics and algal nutrients stripped out in the ponds would not cause trouble downstream. Secondly, larger brackish ponds might be desirable. Very large impoundments are presently being constructed in the high Juneus marshes for mosquito control, sport fishing, and waterfowl hunting. Addition of reasonable amounts of sewage wastes might not prove harmful to these other uses. Finally some results will be applicable to the problems of domestic wastes being dumped directly into estuaries and estuarine eutrophica-tion. (Jones-Wisconsin) W72-10097

NOTES ON THE RELATIVE SALINITY TOLERANCE OF CHANNEL AND BLUE CAT-

TOLERANCE OF CHANNEL AND BLUE CAT-FISH,
Louisiana State Univ., Baton Rouge. School of Forestry and Wildlife Management.
K. O. Allen, and J. W. Avault, Jr.
Progr Fish Cult. Vol 33, No 3, p 135-137. 1971.
Identifiers: \*Blue catfish, \*Channel catfish, Ic-talurus-furcatus, Ictalurus-punctatus, \*Salinity,
\*Tolerance.

In aquariums, blue cattish (Ictalurus furcatus) had a significantly greater salinity tolerance (P<.05) than channel catfish (I. punctatus) of a similar age and size. Fish of both species took food at 14 ppt

### Group 5C-Effects of Pollution

salinity but they lost weight and mortalities were heavy over the 37-day test period. Blue catfish also exhibited a greater ability to reacclimate back to fresh water from saline water .-- Copyright 1972, Biological Abstracts, Inc.

PROGRESS REPORT OF RESIDUE STUDIES ON DICAMBA USED FOR DITCHBANK WEED CONTROL.

Bureau of Reclamation, Denver, Colo. For primary bibliographic entry see Field 03F.

EUTROPHICATION AND FISH MORTALITY IN TWO PONDS IN OSTEND, Ghent Rijksuniversiteit (Belgium). Laboratorium

voor Oecol. R. Jocque, and G. Persoone.

Natuurwetensch Tijdschr. Vol 52, No 4-8, p168-

198. 1970 (1971) Illus. English summary.
Identifiers: Algae, Bacteria, Belgium, Blooms,
Decomposition, \*Eutrophication, \*Fish mortality,
Oscillatoria redekei, Ostend, Water pollution,

In order to detect the cause of recurrent fish mortality in the ponds of the Maria-Hendrika park of Ostend (Belgium), hydrobiological sampling Ostend (Belgium), hydrobiological samplings were made during 1968, twice a month, at 2 different places. A 24-hr cycle, with samplings each 2nd hour, was undertaken in Sept. Next to the detailed physicochemical analysis of the waters, qualitative and quantitative plankton studies as well as analyses of chlorophyl and organoseston were performed each time. The results show that the ponds contain large amounts of nitrates and phosphates, dominance of blue-green place and plankton. As to dominance of blue-green algae and plankton. As to their degree of pollution, the ponds are alpha-mesosaprobic. The continuous presence of a certain amount of nitrites indicate an important ammoniac concentration in the lower layers of the water; moreover the occurrence of the blue-green algae Oscillatoria redekei, typical for the presence of H2S, indicates the formation of important quantities of H2S in the sediments of these shallow ponds. Fish thus suffer chronic poisoning by NH3 and H2S, poisoning which becomes acute, especially for weak specimens, during bacterial decomposition of water blooms.—Copyright 1972, Biological Abstracts, Inc.

KAISER REFRACTORIES ENVIRONMENTAL STUDIES

Moss Landing Marine Labs., Calif.

corange from the National Technical Information Service as COM-71-01107, \$3.00 in paper copy, \$0.95 in microfiche. Final Report June 1, 1971. 61 fig, 33 tab, 77 ref. J. P. Harville, editor, 190 p, Technical Publication 71-3. NOAA Grant No GH-94.

Descriptors: \*California, \*Outlets, \*Industrial wastes, \*Water circulation, \*Bottom sediments, \*Topography, \*Sediment transport, \*Benthic faulankton, Fish, Waste dilution, Bioindicators, Laboratory tests, On-site tests.
Identifiers: \*Moss Landing, \*Kaiser Refractories.

The potential effects of the Kaiser Refractories industrial effluent on the marine environment of the Moss Landing area in California were studied in September 1967. The physical characteristics and dynamics of the water mass in the proposed outfall area were determined and the bottom structure, sediments and sediment transport characteristics were assessed. Biological studies of the benthic fauna in the proposed outfall area, with supplementary studies of plankton, fishes and intertidal fauna were also investigated. The impact of various dilutions of Kaiser effluent upon selected bioindicator plant and animal species was studied in both the laboratory and the field. The results of these more than three years study are summarized.

Characteristics of the potential receiving area, characteristics of the Kaiser effluent and the effect of this effluent on selected organisms are outlined and specific recommendations are suggested concerning outfall construction design to minimize a detrimental environmental impact. (Ensign-PAI) W72-10149

MARINE TRANSPORTATION SYSTEMS OF

THE TRANS-ALASKAN PIPELINE SYSTEM.
Coast Guard, Washington, D.C.
For primary bibliographic entry see Field 05B.

CHEMICAL EXCHANGES BETWEEN SEDI-MENTS AND WATER IN THE GREAT LAKES: SPECULATIONS ON PROBABLE REGULATORY MECHANISMS,
Wisconsin Univ., Milwaukee. Center for Great

Lakes Studies.

C. H. Mortimer.

Limnol Oceanogr. Vol 16, No 2, p 387-404. 1971.

Identifiers: Canada, \*Chemical exchanges, \*Great Lakes, \*Regulatory mechanisms, Minerals, Ox-ygen, Sediments, Speculations.

As long as the O2 concentration at the sediment surface does not fall below 1 or 2 mg/liter, typical deep-water sediments in the Great Lakes will probably be found to exert a measurable but quantitatively unimportant influence on the chemistry of the overlying waters. This conclusion is sup-ported by the case of Windermere. The sequence of more conspicuous changes that take place when the O2 does fall below 1 mg/liter at the interface is illustrated by the case of Esthwaite Water, representative of events in lakes where biological production or organic pollution is high, where the subthermocline volume is relatively small, or both. A progressive decline in O2 concentration from 2 mg/liter to analytical zero at the interface was ac-companied by a fall in electrode potential in the upper few millimeters of sediment, correlated with mobilization and transfer into the water first of Mn and later of Fe. There is a concurrent transfer into the water of substantial quantities of phosphate, previously held in complex form, which may have important biological consequences. Other changes include liberation into the water of ammonia and silicate. Further reduction of the water-sediment system permits microbial reduction of sulfate. A third example of sediment-water exchange occurs during winter stratification under ice cover. In Tornetrask, in the course of 95 days of ice cover, a relatively thin layer of bottom water, initially at IC, gained heat and bicarbonate from and lost O2 to the sediments. The density increase, arising from the heat gain, set density increase, arising from the heat gain, set density currents in motion that drained this contact water into the deepest parts of topographically isolated subbasins... Copyright 1972, Biological Abstracts, Inc. W72-10158

STUDY OF THE POSSIBLE ROLE OF POLLU-TION IN THE PREVALENCE OF SEA NETTLES IN THE CHESAPEAKE BAY AND THE DEVELOPMENT OF A CENSUS TAKING METHOD.

Biospherics Inc., Rockville, Md.

Available from the National Technical Informa-\$0.95 in microfiche. Final Report, October 15, 1971. 135 p, 29 fig, 12 tab, 26 ref. NASW-2115.

Descriptors: \*Sea nettles, \*Pollutants, \*Maintenance, \*Plant morphology, \*Phosphates, \*Nitrates, \*Ammonium compounds, Sewage ef-

\*Nitrates, \*Ammonium compounds, Sewage effluents, Temperature control, Assay, Remote sensing, Algae, Antibiotics, Mercury, Arsenic compounds, Chesapeake Bay. Identifiers: \*Chrysaora quinquecirrha, \*Medusae maintenance, \*Polyp maintenance, \*Polyp metabolism, Tetracycline, Sulfanilamide, Penicilin G, Polymyxin B, Podocysts.

The effect of pollutants on the polyp stage of the sea nettle, Chrysaora quinquecirrha, and a means to detect the medusae form by remote sensing were investigated. Phosphate, nitrate, ammonium, combinations of these, pH from 6-8, and synthetic sewage effluents were examined for maintenance and morphology of the polyps. Phosphate, nitrate, and their combinations were found to contribute to the proliferation of polyps, pH had no effect while ammonium, ammonium combinations and sewage were found to be detrimental to polyps. Phosphate and nitrate seemed to act as a protection against the lethal effects of ammonium. An assay based on the labeled release technique was used to measure polyp metabolism. The results support those obtained in the maintenance study suggesting a potential to predict and support the morphole effects of pollutants on polyps. (Ensign-PAI) W72-10162 hological

D. AWAKA DittamwemNtralwitiscach

THE PRODUCTION OF ORGANIC DETRITUS IN A SOUTH FLORIDA ESTUARY.

Miami Univ., Fla. For primary bibliographic entry see Field 02L.

PORT AND HARBOR SAFETY.

Committee on Merchant Marine and Fisheries (U.S. House). Subcommittee on Coast Guard, Coast and Geodetic Survey, and Navigation. For primary bibliographic entry see Field 06E. W72-10171

THE UPTAKE AND DISTRIBUTION OF ZN-65

IN OYSTERS, Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological

M. G. Romeril. Marine Biology, Vol. 9, No. 4, p 347-354, June 1971. 5 fig, 3 tab, 17 ref.

Descriptors: \*Zinc, \*Radioecology, \*Zinc radioisotopes, \*Oysters, \*Aquatic environment, Water pollution, Public health, Radioisotopes, Radioactive wastes, Absorption, Distribution, Animal physiology. Identifiers: \*Zinc-65, \*Rate studies, Portuguese

oysters, Crassostrea spp., Ostrea spp., Biological half-life. Half-life.

Over a period of 6 weeks in aquaria, Portuguese oysters (Crassostrea angulata) accumulate zinc to a greater extent than do native Ostrea edulis, although intake rates for any particular organ in either species are quite similar. The general distribution pattern of radioactivity in the tissues is similar to that observed for stable zinc and Zn-65 in other oyster species, concentration occurring to the greatest extent in gills and mantle, and lest in muscle. The observed equilibrium concentrations and biological half-lives are considerably less than those measured in the natural environment, and the significance of this and its bearing on the mechanisms of uptake is discussed. Cobalt and iron depress the rate of Zn-65 uptake by both oyster soft tissues and the shell. The limiting effect in soft tissues is probably due to competition for sites at the actual point of uptake. The distribution of Zn-65 in tissue subcellular fractions separated by centrifugation shows the greatest concentration of the radioisotopes in the insolube tissue com-ponents of gills, mantle, and heart. Appreciable amounts of Zn-65 are associated with tissue proteins. (Svensson-Washington) W72-10198

THE OCCURRENCE OF TANTALUM IN SOME MARINE ORGANISMS, Southampton Univ (England). Dept. of Oceanog-

raphy.
J. D. Burton, and K. S. Massie.

Journal of the Marine Biological Association of the United Kingdom, Vol. 51, p 679-683, 1971. 1 tab. 14 ref.

Descriptors: "Radioecology, "Radioactive wastes, 
"Aquatic animals, Neutron activation analysis, 
Aquatic environment, Crustaceans, Mollusks, 
Water pollution sources, Water pollution effects, 
Absorption, Trace elements, Water chemistry. 
Identifiers: "Tantalum, Echinoderms, Tunicates,

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Determinations have been made, by neutron activation analysis, of the concentrations of tantalum in the tissues of some common crustaceans, talum in the tissues of some common crustaceans, mollusks, echinoderms, and tunicates of coastal waters of southern England. The concentrations ranged from less than 0.01 mg/kg dry weight in the muscle of Mytilus edulis to 2.0 mg/kg dry weight in Neomysis integer, which represents the lowest trophic level examined. Two ascidian species showed concentrations of about 0.2 mg/kg dry weight in the whole organism. Results suggest that the average concentration of tantalum in sea water is not greater than 0.02 microgram/i. A generalized concentration factor of 1000 on a wet weight basis applies to the edible parts of mollusks and crustaceans. (Svensson-Washington) W72-10200

CHLORAMINE TOXICITY TO THE AMPHIPOD GAMMARUS PSEUDOLIMNAEUS AND THE FATHEAD MINNOW (PIMEPHALES

Descriptors: \*Chlorination, \*Water pollution effects, \*Chlorine, Lethal limit, Water pollution sources, Water quality, Chemcontrol, Water treatment, Amphipods, Crustaceans, Minnows, Fish

diseases, Bioassay.
Identifiers: \*Chloramine, Gammarus spp.,
Fathead minnow, Pimephales spp.

Amphipods (Gammarus pseudolimnaeus) were subjected to 96 hr and 15 week exposures, and fathead minnows (Pimephales promelas) to a 21 week exposure of various chloramine concentrations under continuous flow conditions. The most marked sublethal effects were reductions in the number of young produced by the amphipod and of eggs produced by the minnow. The 96 hr median tolerance limit (TLm-50) for the amphipod was tolerance limit (1 Lm-30) for the ampaipou was 0.220 mg/l total chloramine. Fathead minnows in the long term study were all killed at the highest concentration, 0.154 mg/l total chloramine, within three days. The lowest measured total chloramine concentration in the long term tests having no significant to the contraction of the concentration in the long term tests having no significant contraction. concentration in the long term tests having no sig-inficant effect was less than 0.0034 mg/l for the amphipod and 0.0165 mg/l for the fathead minnow. (LeGore-Washington) W72-10202

CORRELATION OF DDT AND LIPID LEVELS FOR CERTAIN SAN FRANCISCO BAY FISH, Bureau of Sport Fisheries and Wildlife Sacramen-to, Calif. Div. of River Basin Studies. R.D. Earnest, and P. E. Benville, Jr. Pesticides Monitoring Journal, Vol. 5, No. 3, p 235-241, December 1971. 5 tab, 12 ref.

Descriptors: \*Pesticide kinetics, \*Pesticide residues, \*DDT, \*Chlorinated hydrocarbon pesticides, \*California, Absorption, DDD, DDE, Lipids, Water pollution effects, Path of pollutants, Perches, Fish physiology, Sculpins, Crabs. Identifiers: \*San Francisco Bay (Calif), Lipid content, Flounder, Sole, Sanddab, Micrometrus spp.,

Cymatogaster spp., Racochilus spp., Phanerodon spp., Platichthys spp., Parophrys spp., Citharichthys spp., Leptocottus spp., Cancer spp.

During 1969, residue levels of DDT and its metabolites were determined monthly for eight species of fish and one species of crab collected from two sites in San Francisco Bay, California. Total residue levels were highest in dwarf and shiner perch and lowest in flatfish and crabs. Lipid

concentrations were determined in all animals. concentrations were determined in all animals. Correlation coefficients were calculated for percent lipid versus concentrations of DDE, DDD, DDT, and total DDT (DDE + DDD + DDT). There was a significant correlation (P less than 0.05) between percent lipid and DDT and its metabolites for white perch, pile perch, and staghorn sculpin. Dwarf perch had a negative correlation. (LeGore-Washington) W72-10231 W72-10203

AN INCIDENCE OF FISH MORTALITY IN ATHANKARAI ESTUARY NEAR MANDAPAM, Central Marine Fisheries Research Inst., Mandapam (India).

dapam (India). V. S. Durve, and K. Alagarswami. Journal of the Marine Biological Association of In-dia, Vol. 6, No. 1, p 147-150, 1964. 5 fig, 1 tab, 5

Descriptors: \*Irrigation practices, \*Fishkill, \*Salinity, \*Estuarine environment, Lethal limit, Mortality, Estuaries, Aquatic habitats, Tilapia, Mullets, Clams, Shrimp, Irrigation. Identifiers: Prawns, India.

A fishkill was reported in Athankarai estuary (India) near Mandapam on July 20, 1963. Populations of clams (Meretrix casta) and prawns were also af-fected. The estuary is formed by the Vaigai River, which id diverted for an irrigation program during the summer. It was deduced that the mass mortality resulted from an intolerable increase in the estuarine water's salinity. Local residents reported that the mortality is an annual event. (LeGore-Washington) W72-10204

THE LOCAL EFFECT OF A PUNCTATE WASTE WATER LOADING OF A STANDING BODY OF WATER; A DIRECT DETERMINATION OF THE GROWTH LIMITING EFFECT OF PHOSPHORUS IN LAKE LUCERNE, Eidgenoessische Technische Hochschule, Kastienbaum (Switzerland). Hydrobiology Lab. R. Gaechter, E. Szabo, and A. Mares. Schweiz Z Hydrol. Vol. 33, No 1, p 66-72. 1971. Illus. Mans. English summary.

lus. Maps. English summary. nus. maps. Engins summary.
Identifiers: Water pollution control, \*Water pollution effects, Equation, Growth, Lakes, Loading, \*Lake Lucerne, Mitscherlich, \*Phosphorus, \*Water pollution, Punctate, Switzerland, \*Waste water (Pollution).

The influence of the 'Steinibach' tributary, into which the wastewater of 10,000 inhabitants is discharged, on Lake Lucerne (Horwer Bucht) is detectable in the surface water over a distance of more than 2 km. The increased P supply enables more intensive biological nitrate consumption. The dependence of the pigment concentration, y, on the total P concentration, x can be expressed by the following Mitscherlich equation: log (30-y) = log 30-0.012 (x-6). This was the first time that the influence of an increased P concentration on priinfluence of an increased P concentration on primary production was shown in Lake Lucerne under completely natural conditions. The possibilities of implementing successful water pollution control measures in lakes with various trophic levels are discussed.—Copyright 1972, Biological Abstracts, Inc. W72-10205

THE HALF-LIFE OF BIOLOGICAL ACTIVITY OF ANTIMYCIN DETERMINED BY FISH BIOASSAY,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
L. L. Marking, and V. K. Dawson.

Transactions of the American Fisheries Society, Vol. 101, No. 1, p 100-105, January 1972. 5 fig, 3 tab, 8 ref.

Descriptors: \*Antimycin A, \*Fish physiology, Organic compounds, Rainbow trout, Sunfishes, Goldfish, Catfish, Environmental effects, Toxins.

Identifiers: \*Antimycin, \*Half life, \*Biological half life, Toxicants.

The biological halflife of antimycin, a powerful fish toxicant, was determined using fish bioassays at various test temperatures and pH levels. The at various test temperatures and pH levels. The species exposed, in order of decreasing sensitivity to the toxicant, include rainbow trout, bluegill, green sunfish, goldfish, channel catfish, and black bullhead. Antimycin is deactivated more rapidly at higher temperatures, but the high temperatures did not influence the deactivation as greatly as did high pH levels. The halfilives at the various pH levels are as follows: pH 6.0-6.5 = 310 hr, pH 8.0 = 100 hr, pH 8.5 = 46 hr, pH 9.0 = 9.7 hr, pH 9.5 = 4.6 hr, and pH 10 = 1.5 hr. (LeGore-Washington) W72-10206

STUDIES ON THE EFFECT ON THE BODY AND MIND OF ENVIRONMENTAL CONDITIONS: I. PRELIMINARY SURVEY OF NITRATE INFANT METHEMOGLOBINEMIA AND OF THE NITRATE CONCENTRATION OF THE WATER (IN JAPANESE), Hokkaido Inst. of Public Health, Sapporo (Japan). S. Okada, T. Kohgo, S. Sakaida, M. Watanabe, and S. Shinagawa. Rep Hokkaido Inst Pub Health, Vol 20, p 213-222, 1970. Map. English summary. Identifiers: Body. Concentration, Environment, Globinemia, \*Infants, Mind, \*Nitrates, Survey, \*Potable water.

Infant methemoglobinemia due to high nitrate-containing water and nitrate contamination of drinking water were studied. Infant methemoglobinemia could not be seen in the dis-tricts studied. Studies of wells indicated that well-waters suspected of being implicated in cases of infant methemoglobinemia existed in these areas. The nitrate content of wells was 10-20 ppm or more. Nitrate contaminated water was found most frequently in private wells serving rural homes. The wells were located less than 15 m from the sources of pollution.—Copyright 1972, Biological Abstracts, Inc.

ACID RAIN, Cornell Univ., Ithaca, N.Y. Section on Ecology and Systems. For primary bibliographic entry see Field 05B. W72-10261

PEATLAND TYPES AND THEIR REGIONAL DISTRIBUTION IN SOUTH SWEDEN, T. Mornsjo.

Geol Foeren Sotckh Foerh. Vol 93 (Part 3), p 587-

600. 1971. Illus. Maps. Identifiers: \*Distribution, Lakes, Minerals, Palu-dification, \*Peatland, Soils, \*Sweden, Terrestri-alization, Trophication, \*Soil types.

Peatlands in South Sweden are classified partly as reatands in South Sweden are classified partly as to surface morphology and partly as to stratigraphy and development. Two main categories of peatland are discussed: ombrotrophic peatland (rain-water conditioned) and minerotrophic peatland (supplied with mineral soil water). Each category exhibits types related to differences in hydrotopography, water movements, geomorphology, etc. The basal part in the stratigraphy of peatlands makes it plain that peatlands may be developed by paludification of mineral soil, terrestrialization of lakes, and, as to ombrotrophic peatlands, by ombrotrophication uponeat strata. The regional distribution of South Sweden of peatland types distinguished is reviewed in broad outlines.—Copyright 1972, Biological Abstracts, Inc. W72-10308 category exhibits types related to differences in

RECYCLING AND ECOSYSTEM RESPONSE, Michigan State Univ., East Lansing. Inst. of Water For primary bibliographic entry see Field 06G.

### Group 5C-Effects of Pollution

W72-10323

SOME METHODS OF ASSESSMENT OF TOXIC EFFECTS UPON MARINE INVERTEBRATES, University of Strathclyde, Garelochhead (Scotland). Marine Lab. E. J. Perkins.

Proceedings of Society for Analytical Chemistry: Analytical Division, Chemical Society, Vol 9, No 5, p 105-114, May 1972. 1 fig, 1 tab, 19 ref.

Descriptors: \*Water pollution effects, \*Marine animals, \*Toxicity, \*Lethal limit, \*Analytical techniques, Testing, Toxins, Ecology, Environmental effects, Laboratory tests, Evaluation.

Studies of the toxic effect of effluents and other materials upon a range of marine invertebrate animals are considered. In all experiments, continuous gentle aeration maintained the oxygen levels near saturation. As the pH of sea water is dependent upon the carbon dioxide concentration, the pH was monitored continuously in the test vessels; oxygen levels were determined intermittently. The acute toxicity test was normally performed as a 24-hour exposure to the toxic solution in a no-flow system, followed by a 5-day recovery period. The mortality due to each test solution was defined at the end of this period. The duration of the exposure was extended to 48 or 96 hours if the need arose. Because of severe problems in tank hygiene, no animals were fed during this period. e animals studied were Eupagurus bernhardus, Carcinus maenas, Littorina littorea, L. saxatilis, Thais (Nucella) lapillus, Buccinum undatum, Mytilus edulis, Ostrea edulis and Asterias rubens, but the general concept is applicable to all marine animals. (Woodard-USGS) W72-10347

DISEASE DUE TO 'NONPATHOGENIC' BAC-

TERIA, South Tahoe Public Utility District, South Lake Tahoe, Calif.

For primary bibliographic entry see Field 05F. W72-10368

A COMPARATIVE MICROBIOLOGICAL STUDY OF THE SAPROPELS OF LAKES AKACH-KUL' AND SABANAI IN CHELYABINSK OBLAST. (IN RUSSIAN), I. F. Fedotov.

Tr Sverdl S-Kh Inst. 20: 213-215. 1970. Identifiers: Lake Akach-Kul, Azotobacter, Bacteria, Chelyabinsk, \*Microbiology, Lake Sabanai, \*Sapropels, Sulfate, USSR, \*Lakes.

A comparative microbiological study was used to establish the same sanitary bacteriological varia-bles of the sapropels of lakes Akach-Kul' and Sabanai, which are near the resort of Uvil'da in Chelyabinsk Oblast. Ten times as many azotobacters and denitrifiers were found in Lake Akach-Kul'. Sulfate-reducing bacteria were found in the sapropel of Lake Akach-Kul' but not in that of Lake Sabanai. There were 10 times as many iron bacteria in Lake Sabanai as in Lake Akach-Kul'. The antibacterial action of the sapropel of Lake Akach-Kul' on test microorganisms was greater than that of Lake Sabanai. The sapropel of Lake Akach-Kul' had relatively better microbiological variables than did that of Lake Sabanai.--Copyright 1972, Biological Abstracts, Inc. W72-10388

A MICROBIOLOGICAL AND SANITARY-BA-CTERIOLOGICAL CHARACTERIZATION OF THE SAPROPEL OF LAKE BOLYASH, CHE-

LYABINSK OBLAST, (IN RUSSIAN), I. F. Fedotov, and E. V. Zhuravleva. Tr Sverdl S-Kh Inst. Vol 20, p 216-218, 1970. Identifiers: Azotobacter, Bacteria, \*Lake Bolyash, Chelyabinsk, Lakes, Microbiology, \*Sapropel, USSR, \*Microorganisms.

Azotobacters, butyric acid-fermenting, denitrifying and other microorganisms were found in the sapropel of Lake Bolyash. Under experimental conditions there is a possibility of increasing the number of sulfate-reducing bacteria, azotobacters and butyric acid-fermenting bacteria by heating the sapropel at 60 C for 30 min. The sanitary-bacteriological quality of the sapropel is also improved by heating at 60 C for 30 min. There was considerable intensification of the antibacterial action of the sapropel on test microorganisms after heating, and this activity is retained longer than in unheated sapropel.—Copyright 1972, Biological Abstracts, Inc. W72-10393

POLLUTION IN A CRUSOE ECONOMY, Iowa State Univ., Ames.
For primary bibliographic entry see Field 06A. W72-10428

THE EFFECT OF FARM WASTES ON THE POLLUTION OF NATURAL WATERS, Wisconsin Univ., Madison; and Marathon County Center, Waussau, Wis. For primary bibliographic entry see Field 05B. W72-10430

LIMNOLOGICAL STUDIES OF LAKE JACOMO, JACKSON COUNTY, MISSOURI. I. WATER QUALITY AND SURFACE PLANK-TON, 1970 - 1971, Missouri Water Resources Research Center,

D. H. Stern, and M. S. Stern. Available from the National Technical Information Service as PB-210 587, \$3.00 in paper copy, \$0.95 in microfiche. Missouri Water Resources Research Center Completion Report May 1972. 61 p, 14 fig, 4 tab, 18 ref. Project No. OWRR A-041-MO (1). 14-31-0001-3225.

Descriptors: \*Algae, \*Eutrophication, \*Nutrients, \*Plankton, \*Recreation, \*Water quality, Cyanophyta, Lakes, Missouri, Nitrogen, Identifiers: Lake Jacomo (Mo).

Water quality and surface plankton in Lake Jacomo, the primary recreational water for Kansas City, were studied synoptically from June 1970 through May 1971. The lake, which has 2 million visitors per year, has been culturally eutrophicated by nutrient-rich runoff from watershed land containing farms, feedlots, and urban areas. Nuisance blooms are promoted by its dissected shoreline and relatively small size. Ammonia nitrogen con-centrations ranged from 0.25 ppm to 2.64 ppm, nitrate nitrogen from 0.02 ppm to 1.00 ppm, and orthophosphate from 0.02 ppm to 1.79 ppm. One-hundred and eighty plankton taxa were identified. Cyanophyta, in particular Aphanizomenon flosaquae, were dominant, except in June and from mid-November through January when mid-November through January wher Chrysophyta dominated the plankton. Recommen dations from this study include the following: (1) Purchase or zoning control of the lake's watershed; (2) lake bank stabilization by the Park Department; (3) encouragement of appropriate powerboat operation to minimize wakes along unstable banks; (4) reduction of nutrient-rich runoff from agribusinesses; (5) erosion control by wise construction and farming practices; (6) reduction of blue-green algae by repeated applications of copper sulfate or copper-containing algicides; and (7) limited dredging of productive shallow coves. Aeration and destratification are not recom-mended at this time. (Missouri abstract) W72-10431

THE SHAD FISHERY OF THE ALTAMAHA RIVER, GEORGIA, Georgia Game and Fish Commission, Brunswick. Marine Fisheries Div.

Available from the National Technical Informa-\$0.95 in microfiche. Contribution Series No. 8, December 31, 1971. 42 p, 14 fig, 11 tab, 8 ref.

Descriptors: \*Marine fish, \*Fisheries, \*Georgia, Fishing, Management, Marketing, Aquatic popula-

Identifiers: \*Shad, \*Altamaha River, Alosa sanidissima. Alosa mediocris.

The American shad fishery of the Altamaha River was investigated during 1967 and 1968. Drift gill nets were most widely used with set gill nets ar bow nets used less frequently. Catch and effort data were collected from fishermen and dealers. During the study 1,376 American and hickory shad were tagged and 649 tags were returned. Earlier closing of the commercial fishing season was recommended to avoid harvest of spawning fish in April which were in poor market condition. W72-10437

THE DISTRIBUTION AND DENSITY OF THE BRACKISH WATER CLAM, RANGIA CUNEATA IN THE ALTAMAHA RIVER, GEOR-

Georgia Game and Fish Commission, Brunswick. Marine Fisheries Div. W. F. Godwin.

Available from the National Technical Information Service as COM-72-10194, \$3.00 in paper copy, \$0.95 in microfiche. Contribution Series No. 5, April 1968. 13 p, 5 fig, 1 tab, 3 ref. Grant NMFS-

Descriptors: \*Clams, \*Georgia, \*Fisheries, Distribution, Aquatic populations, Shellfish.
Identifiers: Rangia cuneata, \*Altamaha River

A total of 8, stations in the Altamaha River system were sampled for Rangia cuneata between October 1966 and August 1967. The range of sizes in the Altamaha indicated a long established popula-tion with annual reproduction and recruitment. Most clams were found in areas where salinities were less than 5.5 ppt. Clams were found at 15 stations and concentrations of commercial density found at 5 of the 15. W72-10438

### **5D. Waste Treatment Processes**

AERATOR AND WATER TREATMENT R. E. Eron

U. S. Patent No. 3,653,641, 4 p, 2 fig, 1 ref; Official Gazette of the United States Patent Office, Vol. 897, No. 1, p. 151, April 4, 1972.

Descriptors: \*Patents, \*Aeration, \*Chemical treatment, Pollution abatement, Water pollution, Water pollution treatment, Water treatment, \*Chlorination, \*Bactericides, Separatio techniques, Equipment, \*Waste water treatment. Separation

A rotatable impeller is located at the upper end of an intake tube to sling water outward from the tube with considerable turbulence, increasing the interfacial exposure to the surrounding atbottom of the pond inducing an outward and upward flow of treated water at the pond base. Chemicals such as chlorine or a bactericide are diluted prior to introduction into the body of water thereby insuring that the surrounding ecology is not disturbed. (Sinha-OEIS)

AEROBIC REMOVAL OF PHOSPHATE FROM ACTIVATED SLUDGE, Biospherics Inc., Rockville, Md. (Assignee). G. V. Levin, and G. J. Topol.

U. S. Patent No. 3,654,146, 2 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 897, No. 1, p. 263, April 4, 1972.

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Descriptors: "Patents, "Phosphates, "Activated sludge, "Aerobic treatment, "Biochemical oxygen demand, Sewage treatment, Aeration, Pollution abatement, "Waste water treatment, Water pollution, Water pollution treatment.

A phosphate-rich supernatant liquor is formed and after being aerated has a reduced BOD content. The organisms take up phosphate and the phosphate-enriched sludge is separated to yield a substantially phosphate free effluent. (Sinha-OVES) OEIS) W72-09791

METHOD OF TREATING SPENT PULP

LIQUORS, Weyerhaeuser Co., Tacoma, Wash. (Assignee). G. G. de Hass, L. H. Clark, and C. J. Lang. U. S. Patent No. 3,654,353, 3 p, 2 fig, 6 ref; Offi-cial Gazette of the United States Patent Office, Vol. 897, No. 1, p. 296, April 4, 1972.

Descriptors: \*Patents, \*Pulp wastes, \*Acids, \*Sulfite liquors, \*Chemical wastes, Pollution abatement, \*Acetic acid, Industrial wastes, Waste treatment, \*Waste water treatment, \*Organic acids, Organic wastes, Water pollution, Water pollution treatment, Water quality.

Identifiers: \*Formic acids, Sodium hydroxide.

A method of injecting a reactive compound into the vapor stream that will react with volatile materials to form nonvolatile compounds in the form of crystalline products or solutions of the two compounds is described. It provides for the recovery of acetic, formic and sulfurous acids. Compounds such as sodium hydroxides are injected to convert the acids in the vapor streams to their nonvolatile salts. (Sinha-OEIS)

NITRATE REMOVAL FROM SEWAGE, NITRATE REMOVAL FROM SEWAGE, Biospherics Inc., Rockville, Md. (Assignee). G. V. Levin, and G. J. Topol. U. S. Patent No. 3,654,147, 3 p, 2 fig, 5 ref; Offi-cial Gazette of the United States Patent Office, Vol. 897, No. 1, p. 263, April 4, 1972.

Descriptors: \*Patents, \*Nitrates, Sewage treat-ment, Chemical wastes, \*Nutrient removal, \*Ac-tivated sludge, \*Aeration, Microorganisms, tivated sludge, \*Aeration, Microorganisms, \*Phosphates, \*Biological treatment, Waste water treatment, \*Bacteria, Biochemical oxygen de-

Raw sewage is mixed with activated sludge to form a mixed liquor. Aeration takes place at rate sufficient to convert ammonia to nitrate. The mixed liquor is then passed to a zone where it is kept under conditions of insufficient oxygen. This kept under conditions of insufficient oxygen. This causes the microorganisms to break down the nitrate fulfilling their need by taking oxygen from the nitrate. Nitrogen gas remains and is removed from the system. The phosphate-enriched sludge is passed to a phosphate stripping zone where microorganisms release the phosphate. (Sinha-OEIS) OEIS) W72-09800

PROCESS FOR SEWAGE TREATMENT, Aktiebolaget Vallenbyggnadsbyran (Sweden).

Aktiebonget vanisacyggaaaby.
N. K. G. Westberg.
U. S. Patent No. 3,652,406, 4 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 4, p 1427, March 28, 1972.

Descriptors: \*Patents, Sewage treatment, \*Biological treatment, \*Bacteria, \*Activated sludge, \*Acration, \*Waste water treatment, Pollution abatement, Water pollution, Water pollution, treatment, Separation techniques.

Sewage enters a pre-treatment system which consists of a strainer and sand trap. The pre-treated water is fed to a primary basin from which separated sludge passes via a homogenizing device to a separate cultivating tank where an activated sludge is produced. The activated sludge is then instudge is produced. The activated sludge is then in-troduced into the sewage at one or more points be-fore or after the inlet to the biological oxidizing device. The combined materials are led into coagu-lating tanks. Sludge is removed by sedimentation, floatation or filtration and the purified sewage passes out separately. (Sinha-OEIS) W72-09802

CYANIDE REMOVAL, Calgon Corp., Pitaburgh, Pa. (Assignee). For primary bibliographic entry see Field 05G. W72-09807

TREATMENT OF BIOLOGICAL SLUDGE, Simon-Carves Ltd., Stockport (England). (assignee) A. P. Aldridge.

U. S. Patent No. 3,650,403, 3 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 3, p. 950, March 21, 1972.

Descriptors: \*Patents, Slurries, Sewage sludges, \*Heat treatment, Evaporation, \*Evaporators, \*Organic wastes, \*Waste water treatment, Pollution abatement, Separation techniques, Equipment, Water pollution, Water pollution treatment, \*\*State Sludge treatment.

The treatment consists of feeding the slurry through an evaporator plant where it is subjected to heat treatment and where its water content is removed by evaporation, filtering the slurry which has passed through the evaporator, and recycling the aqueous filtrate for further treatment with the slurry in the evaporator plant. (Sinha-OEIS) W72-09809

COMPLETE MIX SEWAGE TREATMENT

SYSTEM, Chicago Bridge and Iron Co., Aurora, Ill. (As-J. D. Walker.

U. S. Patent No. 3,649,529, 5 p, 11 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 2, p. 722, March 14, 1972.

Descriptors: \*Patents, \*Sewage treatment, Activated sludge, \*Aeration, Water pollution, Water pollution treatment, Pollution abatement, Separation techniques, \*Waste water treatment.

Aeration, mixing, and uniformity throughout a tank are improved by liberating air along lines positioned to generate in the contents of the tank rolls having their axes on a bias. Complete mixing may be enhanced by feeding a mixture of raw sewage and return activated sludge to the tank at feed points so scattered that no part of the tank at far from a feed point. (Sinha-OEIS) W72-09811

PROCESS OF PURIFYING WATER WITH ACTIVE HALOGEN COMPOUND AND ACTINIC RADIATIONS, Midwest Research Inst., Kansas City, Mo. (As-

J. A. Meiners, and E. P. Shea.
U. S. Patent No. 3,649,493, 5 p, 1 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 2, p. 714, March 14, 1972.

Descriptors: \*Patents, \*Water purification, \*Halogens, Oxidation, \*Irradiation, Water treatment, Light, \*Ultraviolet radiation, \*Waste water treatment, \*Microorganisms.

Oxidizable impurities are substantially reduced by oxidation with a hypohalous acid forming compound in the presence of actinic light, irradiated

from a source maintained in close proximity to the water. The actinic light is radiated in a wave length ranging from about 250 to 550 millimicrons from an electric arc source disposed in close proximity to the water being exposed. The pH of the water is maintained slightly acidic in the range of 4 to 6. The actinic light is radiated in intensity sufficient to impart from 1 to 30 watt-minutes per gallon. (Sinha-OEIS)

METHOD OF TREATING INDUSTRIAL WASTE WATER WITHOUT CONTAMINATION OF THE ENVIRONMENT, Nyby Bruks Aktiebolag, Nybybruk (Sweden).

U. S. Patent No. 3,647,686, 3 p, 1 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 1, p 270, March 7, 1972.

Descriptors: \*Patents, \*Chemical treatment, \*In-Descriptors: 'Patents, 'Chemical treatment, 'Industrial wastes, Wastes water, Pollution abatement, 'Metals, 'Nitrates, 'Fluorides, Water pollution, Water pollution treatment, 'Waste water treatment, 'Ammonia, 'Alkali, 'Hydrogen ion concentration.

Industrial waste containing metals, nitrates, and fluorides is treated by converting the fluoride ions to insoluble fluorides, neutralizing the waste water with an ammoniacal neutralizing agent and adding excess ammonia to a pH of at least 8, filtering, adding an alkali hydroxide to the filtrate, distilling off the content of ammonia and finally removing any solid phase from the distillation residue. (Sin-M-2018) W72-09817

DEVICE FOR PURIFYING POLLUTED

WAIEK, Orenstein-Koppel und Lubecker Maschinenbau A.G. (West Germany). For primary bibliographic entry see Field 05G. W72-09818

METHOD AND APPARATUS FOR THE FAIL-SAPE INTRODUCTION OF A BACTERICIDAL GAS INTO LIQUID SEWAGE, Ontario Research Foundation, Toronto. (As-

Ontario Resignee).
D. K. Smith, and A. J. Last.
U. S. Patent No. 3,531,406, 4 p, 2 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 5, p. 1362, September 29, 1970.

Descriptors: "Patents, "Pathogenic bacteria, 
"Viruses, "Liquid wastes, "Sewage bacteria, 
Equipment, Pollution abatement, Water pollution, 
Water pollution treatment, Waste water, "Waste water treatment, "Bacteria, "Gases, "Disinfection, "Chlorination, Water treatment, "Halogens.

A method and apparatus are provided for disin-fecting sewage by the use of chlorine gas at a point which causes a maximum disruption of the sewage which causes a maximum outspins on the sewage so that the particulate matter is promptly com-minuted and pathogenic bacteria and viruses are destroyed. A vortex of low-pressure is created in the liquid by injecting it tangentially into a vortex chamber having a coaxial outlet tube. As the rotatchaimber naving a constant outer tube. A the rotat-ing liquid passes from the chamber into the tube it increases its rotational speed creating a zone of low pressure. The low pressure is utilized to draw the chlorine gas into contact with the liquid. (Sinha-OEIS)

METHOD AND APPARATUS FOR TREATING

WASTE, Industrial Filter and Pump Manufacturing Co., J. F. Zievers, C. W. Riley, and R. W. Crain.
U. S. Patent No. 3,532, 405, 4 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 5, p. 1361, September 29, 1970.

### **Group 5D—Waste Treatment Processes**

Descriptors: "Patents, "Alkalis, "Chlorination, "Oxidation, "Metals, "Industrial wastes, "Chromi-um, "Waste treatment, "Chemical wastes, "Waste water treatment, Pollution abatement. Identifiers: Metal finishing wastes, \*Cyanide

A method and the apparatus are provided for pre-mixing continuously the toxic treating chemicals with waste fluid by means of an aductor, prior to with waste fluid by means of an aductor, prior to ejecting the toxic chemicals into the mixing chamber. The system for treating wastes from metal finishing processes includes vertically-spaced, motor driven impellers in a mixing chamber and a sump pump for discharging continuously a portion of the waste liquid into one inlet and the remainder to another inlet for separate treatment. (Sinha-OEIS) W72-09820

SEWAGE TREATMENT SYSTEM, Union Tank Car Co. (Assignee). B. L. Goodman, R. M. Appleberry, J. W. Struewing, and F. G. Weis.
U. S. Patent No. 3,531,404, 4 p, 3 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 5, p. 1361, September 29, 1970.

Descriptors: \*Patents, \*Sewage treatment, Water pollution, \*Sludge treatment, Pollution abatement, Dewatering, \*Filtration, \*Gravity, \*Screens, Waste treatment, \*Waste water treatment, Separation techniques, Flocculation, Equipment, Water pollution treatment.

A gravity filtration process and apparatus are pro-vided for concentrating and dewatering sewage treatment sludges. The sludge is flocculated and flows by gravity onto a primary screen for water drainage. The sludge is deposited on a secondary screen where a scraping action releases more water from the sludge mass. The secondary screen being in the form of a belt-type conveyor, the sludge is carried through a series of compressor rollers which squeeze out additional water. The screens are made of monofilament material. (Sin-W72-09821

TREATMENT OF AN AQUEOUS WASTE STREAM FROM A HYDROCARBON CONVERSION PLANT WITH CONTINUOUS RECYCLE OF THE TREATED AQUEOS STREAM, Universal Oil Products Co., Des Plaines, Ill. (Assignee). P. Urban

U. S. Patent No. 3,531,395, 7 p, 1 fig, 1 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 5, p. 1359, September 29, 1970.

Descriptors: \*Patents, Pollution abatement, \*Sulfur, \*Nitrogen, \*Ammonia, \*Organic compounds, \*Recycling, Water treatment, \*Waste water treatment, Industrial wastes, \*Oxidation, Water pollument, \*Industrial wastes, \*Oxidation, Water pollument, \*Industrial wastes, \*Oxidation, \*Industrial wastes, \*Oxidation, \*Industrial wastes, \*Oxidation, \*Industrial wastes, \*Indus tion, Water pollution treatment, Chemical treat-

A hydrocarbon charge stock containing sulfurous and nitrogenous contaminants is converted and sulfur and ammonia recovered. The hydrocarbon charge stock, hydrogen and an aqueous recycle stream containing ammonium polysulfide is contacted with a hydrocarbon conversion catalyst at conversion conditions sufficient to form an effluent stream containing substantially sulfur-free and nitrogen-free hydrocarbons, hydrogen, NH3, H2S, and H2O. The effluent is cooled and separated. The aqueous waste stream is treated with oxygen to produce an effluent containing NH4OH, (NH4)2S2O3 and elemental sulfur or ammonium polysulfide. There is a continuous recycling of the treated water with consequent abatement of water pollution. (Sinha-OEIS)

RECOVERING ELEMENTAL SULFUR FROM WATERS CONTAINING HYDROGEN SUL-Freeport Sulphur Co., New York. (Assignee).

V. H. Brogdon. U. S. Patent No. 3,531,251, 4 p, 1 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 5, p. 1331, September 29, 1970.

Descriptors: \*Patents, \*Sulfur, \*Hydrogen sulfide, \*Inorganic compounds, \*Nitrogen, Oxidation, \*Sulfur compounds, Pollution abatement, \*Waste water treatment, Water pollution, Water

Water is stripped of hydrogen sulfide with nitrogen gas, without adding external heat. About one-third of the hydrogen sulfide removed from the water is oxidized to sulfur dioxide and the resulting sulfur dioxide reacted with the remainder of the hydrogen sulfide to produce elemental sul-fur. The sulfur is removed from the system. The remaining uncondensed inert gases, consisting primarily of nitrogen, are recycled to strip hydrogen sulfide from additional amounts of water containing it. (Sinha-OEIS)
W72-09823

SEWAGE TREATMENT SYSTEM, Environmental Services, Inc., York, Pa. (As-

U. S. Patent No. 3,530,990, 5 p, 12 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 878, No. 5, p. 1268, September 29, 1970.

Descriptors: \*Patents, \*Aeration, \*Bacteria, \*Biochemical oxygen demand, Water treatment, \*Sewage treatment, Waste water, \*Waste water treatment, Pollution abatement, Water pollution treatment, Oxidation, Organic wastes.

A tank arrangement has one or more compart-ments separated by baffles for restricted passage of liquid. Each primary compartment has a pneumatic circulator unit which operates to receive segregated quantities of influent to be treated. unit has a sparger connected to a power operated air compressor which functions to super-saturate segregated quantities of the influent with air. The product is discharged into sub-compartments of each primary compartment for ac-celerated growth of bacteria and to reduce the BOD to an acceptable limit. (Sinha-OEIS)

COMBINED STEEL MILL AND MUNICIPAL WASTEWATERS TREATMENT. National Steel Corp., Weirton, W. Va. Weirton Steel Div.

Copy available from GPO Sup Doc EP2.10:12010DTQ02/72, \$1.50; microfiche from NTIS as PB-210 198, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, 157 p, 28 fig, 59 tab, 8 ref. EPA Program 12010 DTQ 02/72.

\*Industrial wastes, Sedimentation, wastes, \*Activated sludge, Sedimentation, Laboratory tests, Analytical techniques, Organic loading, Flow rates, Pollutant identification, Design criteria, Technical feasibility, Economic feasibility, \*Waste water treatment. Identifiers: Waste characterization, \*Combined

A systems evaluation was made to determine the A systems evaluation was made to determine the feasibility and economics of treating selected steel mill and sanitary wastewaters in a municipal sewage treatment plant. The project was Phase I of a three phase program to demonstrate that industries and municipalities through cooperative action can combine their wastewaters and attain their individual treatment goals in an efficient and economical manner. Detailed field work was carried out at the steel plant and the total sewage plant treatment system. Selected steel plant wastes were combined with municipal wastes and evaluated in both batch and continuous treatability bench scale studies. The investigation revealed that it is technically and economically feasible to

co-treat selected steel plant wastes with municipal wastewaters. A demonstration plant would further develop the specific operating procedures such as sludge concentration control, pH control, and rates of waste additions so that the process scheme could be routinely implemented in similar situations. (Lowry-Texas) W72-09825

COST TO THE CONSUMER FOR COLLEC-TION AND TREATMENT OF WASTEWATER, Environmental Protection Agency, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. Onio. Advanced waste Freatment Research Lab.
R. Smith, and G. Eilers.
Copy available from GPO Sup Doc EP2.10:17090-07/70, \$1.00; microfiche from NTIS as PB-210 199, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, 86 p. 13 fig, 30 tab, 29 ref. EDA Program 17090-07/70.

Descriptors: \*Sewage treatment, \*Sewers, \*Terti-Descriptors: "Sewage treatment, "Sewers, Terriary treatment, Construction costs, Annual costs, Cost comparisons, Allocation (Cost), Income analysis, Comparative costs, Maintenance costs, Operating costs, Unit costs, Water costs, Cost trends, Economies of scale, Efficiencies, Interest rate, Prices, Salaries, Water rates, "Costs, "Waste

The national average per capita cost for collection and treatment of municipal wastewater is com-puted based on the 1968 Inventory of Municipal Waste Treatment Facilities in the United States and per c apita cost relationships for building and operating collection and treatment facilities. All costs are given per capita served with treatment facilities using the level of treatment existing in 1968. Total cost was computed as \$19.80 per capita per year. Of this total, \$15.31 represents amortization charges and \$4.49 represents current charges. The total cost can also be broken down as \$13.34 for collection, \$4.38 for treatment and \$2.08 for overhead such as customer services, administra-tive, and general. The cost of collection is, therefore, about three times as expensive as treatment. Nationally, about 23% of the total cost is paid as sewerage usage charges. This represents about 0.1% of National Personal Consumption Expenditures. Expenditure for water supply averaged \$13.42 per capita per year and this is about equal to the amount paid by the consumer in user charges for water supply. The current status of collection and treatment in the United States is discussed and estimates are made of needed additional expenditure. (Lowry-Texas) W72-09826

KINETICS OF REMOVAL OF MIXED CARBOHYDRATES IN ACTIVATED SLUDGE PROCESSES, Georgia Inst. of Tech., Atlanta. School of En-

gineering. S. Ghosh, F. G. Pohland, and W. E. Gates.

Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, Purdue University Engineering Exsion Series No. 137, p 365-381, 14 fig, 2 tab, 20

Descriptors: \*Waste assimilative capacity, \*Activated sludge, "Kinetics, Growth rates, Metabol-ism, Oxidation, Chemical oxygen demand, Synthesis, Sludge, Enzymes, Carbohydrates, Laboratory tests, Analytical techniques, "Waste Laboratory team.
water treatment.
\*Michaelis-Menton

\*Specific growth rate, Detention time, Glucose, Galactose.

Three sets of steady state experiments were per-Three sets of steady state experiments were por-formed in a specially designed continuous culture apparatus using glucose, galactose, and glucose-galactose mixtures as substrates. Substrate con-centrations, total solids concentrations, dehydrogenase activity, pH, dissolved oxygen (DO), and temperature were determined at selected intervals. Data obtained were used to formulate generalized equations expressing the

course of uptake of individual sugar substrates course of uptake of individual sugar substrates from a mixture, identify the substrate which controls growth and substrate utilization rates in mixed substrate systems and delineate its mixed substrate systems. of single and mixed substrate processes in terms of of single and mixed substrate processes in terms of effluent quality and substrate requirements for synthesis and energy production. Results indicated that growth yield and specific growth rates in mixed systems are controlled by the concentration of the component substrate which allows relatively minimum generation time and maximum biomass yield. Introduction of less efficient substrates into systems treating highly biodegradable substrates requires that longer detention times be used to avoid effluent deterioration, but sludge productions per unit mass of mixed substrate removed were less at all detention times than those ned for single substrates due to higher maintenance energy requirements in mixed substrate metabolism. (Lowry-Texas) W72-09829

A NEW METHOD FOR THE TREATMENT OF MUNICIPAL WASTEWATER, Copenhagen Univ. (Denmark).

Copenhagen Univ. (Denmark).
S. E. Jorgensen.
Water Pollution Control, Vol 71, No. 2, 1972, p 210-215, 5 fig, 6 tab, 9 ref.

Descriptors: \*Chemical precipitation, \*Ion exchange, \*Municipal wastes, Separation techniques, Sedimentation, Ammonia, Nutrients, Hydrogen ion concentration, Carbon dioxide, Pilot plants, Cost analysis, \*Waste water treat-

Identifiers: \*Elution, \*Regeneration.

A new wastewater treatment system involves a combination of two well known processes. After grit removal, either aluminum sulfate, iron chloride, or calcium hydroxide is added to the in-fluent to induce chemical precipitation. After 1 1/2 hours of settling, the overflow is treated by a caexchanger consisting of sulphonated cellulose, followed by an anion exchanger. Com-parisons between conventional mechanical-biolog-ical treatment and data obtained from a 4.5 m3/hr pilot plant were made. For mechanical-biological treatment, removals average 92%, 53%, and 12.5% for BOD, phosphorus, and nitrogen, respectively, while for the two stage pilot treatment unit, removals averaged 98, 99, and 43% respectively. Costs of chemicals are approximately 0.09 D.Cr. produced is superior in quality to most surface water supplies. (Lowry-Texas)

W72-09830 per m3 water without ammonia removal and 0.29 D. Cr./m3 with ammonia removal. Product water

SLUDGE DEWATERING BY HIGH-RATE FREEZING AT SMALL TEMPERATURE DIF-

Denver Univ., Colo. Dept. of Chemical Engineer-

ing. C. Cheng, D. M. Updegraff, and L. W. Ross. Environmental Science and Technology, Vol 4, No. 12, December 1970, p 1145-1147, 3 fig, 3 ref.

Descriptors: \*Sludge treatment, \*Dewatering, \*Freeze drying, Freeze-thaw tests, \*Waste water treatment, Temperature, Activated sludge, Time, Heat transfer, Aluminum, Sludge. Identifiers: Film-freezing, Primary sludge, Digested sludge, Return activated sludge, Cooling bath stirring, Alum.

Laboratory studies showed that when sludge was frozen via the film-freezing principle, the dewater-ing characteristics were comparable to those ob-tained with extended freezing, but freezing time and temperature differences were greatly reduced. Experiments were conducted on primary, activated, return activated and digested sludge in 1/8 inch sludge canisters using a controlled-tempera-ture bath of ethylene glycol. Freezing was complete within 5 minutes at a temperature difference (between bath and sludge) equal to -5 deg C with an overall heat transfer coefficient of U = 29 Btu/ft2- hr-deg F compared to 10 minutes at a lower cooling bath stirring rate having an overall heat transfer coefficient of U = 12. The film freezing principle takes advantage of the high thermal admittance of thin-ice films, so that the controlling heat removal mechanism was the cooling bath stir-ring rate. The addition of at least 20 ppm Al as alum was necessary for efficient dewatering. (Gal-

HEAT TREATMENT PROCESS IMPROVES ECONOMICS OF SLUDGE HANDLING AND DISPOSAL.

Envirotech Corp., Brisbane, Calif. Marketing Mu-

nicipal Equipment Div.
R. Sherwood, and J. Phillips.
Water and Wastes Engineering, Vol 7, No. 11, 1970, p 42-44, 1 fig. 1 tab, 7 ref.

Descriptors: \*Sludge, \*Heat treatment, \*Vacuum drying, Filtration, Temperature, Pressure, Flow rates, Heat exchangers, Landfills, Cost analysis, \*Waste water treatment, Treatment facilities, Colorado, \*Sludge treatment.

Identifiers: Sludge dewatering, Colorado Springs

The Porteus Sludge Heat Treatment process is being successfully applied at Colorado Springs, Colorado for volume reduction of municipal sludge. The process components include a large grinder, high pressure (250 psig discharge) positive displacement pumps, and a steam heated pressure vessel with sufficient volume to provide 30 min. retention time. The Colorado Springs unit was designed to treat 4500 gph of sludge containing 96-99% water. Prior to installation of the Porteus process, a 5% solids sludge steam was dewatered directly on a vacuum filter to a 20% solids sludge stream for haulage to a landfill. Chemical cost alone for sludge conditioning chemicals was \$18 to \$20 per ton dry solids produced. Vacuum filter rates of 5 lb per ft2 per hour were common with the previous method. Installation of the Porteus system has boosted vacuum filtration rates to an average of 121 lb per ft2 per hour, resulting in a filter cake with 40 to 50% sludge solids content, with no conditioning chemicals necessary. Cost of the Porteus process is \$2/ton dry solids. In addition, a net solids reduction of 30% is achieved in the reactor. The impact of the recycle BOD5 on the system is also evaluated. (Lowry-Texas) W72-09833

INDUSTRIAL WASTE TREATMENT IN THE

USA TODAY,
Department of the Interior, Washington, D.C.
R. W. Thieme.

Proceedings, Industrial Waste Conference, 25th, May 7-9, 1970, Purdue University Engineering Extension Series No. 137, p 725-730.

Descriptors: \*Industrial wastes, \*Agriculture, \*Municipal wastes, \*Cost sharing, Cost trends, \*Waste water treatment, Pollution abatement, Recirculated water, Reclaimed water, Water pollution sources. Identifiers: Waste water strength.

Industrial waste were compared to other major sources of pollution, namely municipal sewage and agricultural wastes. Waste water discharges from the major industries exceed 13 trillion gallons annually versus 5 trillion gallons of domestic waste water from that part of the population served by sewers. The Interior Department has developed a policy of joint treatment of industrial and mu-nicipal wastes whenever possible with industry to pay its fair share of the cost of treatment. Reuse and recycling concepts should receive increased consideration by industry. Since charges relating to both the volume and strength will be rendered for a waste discharged into a municipal system, it should be an incentive to industry to cut down on

those wastes. If industries wish to move into unspoiled environments, they must accept the responsibility for effective pollution control that will be demanded of them. (Galwardi-Texas)

TREAT HYDROCARBON PROCESSING INDUS-TRIAL WASTES WITH BUGS, Continental Oil Co., Billings, Mont.

D. B. Skogen.

Proceedings, Industrial Waste Conference, 25th, May 7-9, 1970, Purdue University Engineering Ex-tension Series No. 137, p 721-724, 1 fig, 2 tab.

Descriptors: "Oxidation lagoons, "Oil wastes, "Industrial wastes, Aerobic treatment, Steam, Operating costs, Sedimentation, "Biological treatment, "Waste water treatment, Phenols, Ammonia, Sulfides, Montana, Temperature, Nutrients, \*Montana.

Identifiers: API separator, Multi-stage holding ponds, Steam stripping, \*Billings (Mont).

The Continental Oil Company has reduced major illutants in the wastewater effluent of its Billi pollutants in the wastewater effluent of its Billings Refinery by over 90 percent by the use of three wastewater collection and treatment systems. The wastewater contection and treatment systems. I need first system treats sour water contaminated with phenols, sulfides and ammonia by steam stripping, followed by two aerated biological oxidation ponds that operate in series. The ponds operate at a detention time of 1.5 days and at a temperature of between 105 to 110 degrees F by the use of of between 103 to 110 degrees F by the use of steam spargers. Nutrients in the form of trisodium phosphate and potassium hydroxide have been fed daily. The effluent from the biological ponds flows into the first of two aerated holding ponds. The second system treats all oily waters by the use of an API oil separator with the cil free water pumped into the first biological oxidation pond. The third system treats the boiler plant blowdown and the recipilative cooling water system blowand the recirculating cooling water system blow-downs for solids removal by sedimentation with the clear water being pumped into the second hold-ing pond for further aeration. The amount of water biologically treated averaged 225 gpm, and total daily operating costs of 145 dollars per day were reported along with operating costs for each ment of the treatment plant. (Galwardi-Texas)

THE TREATMENT OF EFFLUENTS FROM A CHROME SIDE LEATHER TANNERY ON A CONVENTIONAL BIOLOGICAL FILTER,

British Leather Manufacturers' Research Association, Egham (England). D. A. Bailey, K. S. Robinson, Stella Collins, and J.

N. L. Clarke. Water Pollution Control, Vol 71, No. 2, 1972, p 202-209, 7 fig, 2 tab, 3 ref.

Descriptors: "Tannery wastes, "Biodegradation, \*Trickling filters, "Industrial wastes, Municipal wastes, Organic loading, Suspended solids, Sludge, Neutralization, Sedimentation, Cost analysis, "Waste water treatment, "Biochemical oxvgen demand.

A laboratory scale biological filter packed with 51 mm dia. hard coke was operated on pretreate chrome side leather tannery effluent. BOD removals at loading rates of 0.050 kg BOD/m3-day were generally satisfactory, although effluent suspended solids content were not. Based on the suspended sound content were not. Based on the laboratory information, a pilot plant unit was designed to treat 1/200 of the flow at a tannery. Provision was made for mixing and balancing the proportionately sampled crude effluents, adjustment of the pH and flocculation of suspended solids, followed by sedimentation and treatment of the author linear than the content of the pH. the settled liquors by a biological filter. Pretreatment by neutralization and settling produced an average BOD removal of 38%, while biological treatment removed an average 86% of the remaining BOD for an overall average reduction of 90%.
The BOD loading was 0.125 kg/m3-day.
Suspended solids removals were unsatisfactory,

### **Group 5D—Waste Treatment Processes**

but the fault was one of poor design of the sedi-mentation system. An analysis of the cost data for each particular installation is necessary before any determination of the relative economics of in-plant treatment versus sewer charges for municipal treatment can be evaluated. (Lowry-Texas) W72-09838

SAN MATEO CONSTRUCTS OUTFALL INTO SAN FRANCISCO BAY dateo City Dept. of Engineering, Calif.

R. G. Bezzant. Water and Sewage Works, Vol 117, No. 5, May 1970, p 168.

Descriptors: \*Sewage treatment, \*Outlets, \*Discharge lines, \*Waste water disposal, \*Incineration, \*Pipe, \*Reinforced concrete, Sludge control systems, Laboratory equipment, Treatment facilities, California.

Identifiers: Primary treatment, Outfall line, San Francisco Bay, \*San Mateo (Calif).

The City of San Mateo received a Federal Water Pollution Control Administration grant under PL 660 of 33 percent of \$2,453,700 for the cost of additions to its primary treatment plant for a deep water outfall line for the discharge from its primary treatment plant serving 90,000 San Francisco Peninsula residents. The 54 inch diameter outfall line, constructed of reinforced concrete, was laid ig the floor of the San Francisco Bay approximately 250 feet north of the San Mateo-Hayward Bridge and extended into the bay a distance of some 3,700 feet. The plant additions included a sive-hearth incinerator and controls which replaced existing digesters, a pumping plant, and a new control house which includes an expanded laboratory. (Galwardi-Texas) W72-09839

LOADS ON BURIED PIPES,

Missouri Univ., Rolla. Dept. of Civil Engineering. G. F. Mouser, and R. H. Clark. Water and Sewage Works, Vol 117, No. 7, 1970, p 260. 1 fig. 1 ref.

Descriptors: \*Loads, \*Pipes, Load distribution, Soil physical properties, Soil types, Trenches. Identifiers: Nomograph, Marston's formula, Rigid

A nomograph was developed for the solution of a formula used to determine the load on buried rigid pipes. Marston's Formula, W = CwB2, where W equals the load on the pipe, lb/linear ft; C equals a load coefficient, a function of pipe depth, trench width and type of soil; w equals the weight of backfill, lb/ft3 and B equals the width of trench at the top of the pipe, ft., was used in developing the nomograph. Various soil conditions are considered by the nomograph, and example calculations using the nomograph are shown. (Galwardi-Texas) W72-09840

DEFINEDY INSTALLS SECRECATED SEWERS.

Water and Sewage Works, Vol 117, No. 2, February 1970, p 66.

Descriptors: \*Sewers, \*Oil wastes, \*Oxidation lagoons, Oil industry, \*Waste water treatment, \*California, Pipes, Diffusion, Asbestos cement, Surge tanks, Water reuse.

dentifiers: Segregated sewers, Transite pipe, \*San Francisco (Calif), Phillips Petroleum Com-pany, API separator, Diffusion line.

Phillips Petroleum Company's Avon Refinery near San Francisco has completed a multi-million dollar quality control program. The project consisted of a segregated sewer system, one to collect process water from refinery equipment and the other to handle clean water. The project also included the

construction of a 100-acre oxidation pond for secondary treatment of the process water. Phillips has increased the reuse of its process water and thus has reduced its outflow from 40 mgd to 20 mgd in 1966 with a further reduction to well below 10 mgd expected. Nearly 45,000 ft. of asbestos-cement 'Transite' sewer pipe was used in the segregated sewer system. Epoxy-lined pipe was used for the process water sewer where chemical used for the process water sewer where chemical attack could be anticipated. The process water passes through an API separator and a 20 acre surge tank before being pumped into the 100 acre oxidation pond. The clean water canal has been combined with the oxidation pond effluent before discharge into Suisun Bay through a .5 mile long diffusion line. (Galwardi-Texas) W72-09841

THE SHEFFIELD SLUDGE INCINERATION PLANT, Sheffield Water Pollution Control Dept. (En-

gland). H. B. Tench, L. F. Phillips, and K. H. Swanwick. Water Pollution Control, Vol. 71, No. 2, 1972, p 176-184, 3 fig, 4 tab, 3 ref.

Descriptors: \*Municipal wastes, \*Sludge disposal, \*Incineration, Vacuum drying, Filtration, Design criteria, Temperature, Odors, Operation and maintenance, Construction costs, Operation costs, Air pollution. \*Waste water treatment.

After numerous problems were encountered in tipping of press cake from vacuum filters, an in-cineration plant was installed which included the following components: (1) sludge handling plant including rail track, skiphoist, hopper, breakers, and conveyors housed in a sludge feed building; (2) 2 Nichols Herreshoff furnaces with 9 hearths and an 8.3 tons of sludge cake/hour capacity; (3) an ash handling plant; (4) an electricity substa and instrument room; and (5) a brick-built shed for housing two diesel-electric locomotives. The entire sludge production has been dewatered and in-cinerated since March of 1969. Operational problems since start-up have included: (1) achieving a steady feed rate of cake of a consistent quality which has been reduced to a suitable maximum particle size; (2) controlling furnace conditions to prevent rising and falling of the burning zone and to keep combustion hearth temperatures within the desired range; (3) designing a method of operation which minimizes refractory damages; and (4) 'cleaning up' the plant of dust and ash problems. Capital cost of the plant was 396,000 pounds. Operational costs have been only slightly higher than anticipated and are expected to decrease with increasing operator experience. (Lowry-Texas) W72-09842

TERTIARY TREATMENT OF EFFLUENT FROM SMALL SEWAGE WORKS, Hitchin Rural District Council (England).

R. G. Walker. Water Pollution Control, Vol 71, No. 2, 1972, p 198-201, 7 tab, 6 ref.

Descriptors: \*Tertiary treatment, \*Irrigation, \*Filtration, Sands, Gravels, Grasses, Suspended solids, Biochemical oxygen demand, Operation and maintenance, Construction costs, Operating costs, Planning, \*Waste water treatment.

Sufficient data as to the operation and costs of grass plot irrigation systems, slow sand filters, and upward-flow clarifiers when used as polishing devices for small wastewater treatment systems have been assembled to allow comparisons of the three. Results indicate that: (1) grass plots remove the highest proportion of BOD, but are second to slow sand filters in suspended solids reductions; (2) slow sand filters are second to grass plots in BOD removals; (3) upward-flow clarifiers are least efficient in both BOD and SS removals, but they require the least maintenance while producing a siderable improvement in humus tank effluent. Capital costs per person served by grass plot irrigation ranged from 0.535 to 2.299 pounds; for slow sand filters the capital costs were between 3.81 and 4.66 pounds per person served; and for upward-flow clarifiers a capital cost of 0.22 pound/person served was reported. Maintenance costs were reported as 0.0948, 0.2616, 0.1275, 0.1981, 0.041 pound/person/year for 3 different grass plots, a slow sand filter, and an upward-flow clarifier, respectively. (Lowry-Texas) W72-09844

TERTIARY TREATMENT OF COMBINED

WASTEWATER,
Calgon Corp., Pittsburgh, Pa. Filtrasorb Div.
R. H. Zanitsch, and J. M. Morand.
Water and Wastes Engineering, Vol 7, No. 9, September 1970, p 58-60, 4 fig, 1 tab, 3 ref.

Descriptors: \*Industrial wastes, \*Tertiary treat-ment, \*Activated carbon, Adsorption, Isotherms, Color, Suspended solids, Municipal wastes, Dyes, Solubility, Activated sludge, Pilot plants, Techni-cal feasibility, Economic feasibility, Water reuse, \*Waste water treatment. Identifiers: \*Refractory materials

An activated carbon adsorption isotherm was conducted on a grab sample and a 7-day composite sample of the effluent from a 100,000 gpd pilot plant treating mixed domestic and industrial wastes. The success of the isotherm study prompted pilot scale carbon column investigations which demonstrated the feasibility of using activated carbon to remove refractory organics from an otherwise excellent effluent. After 20,000 gal of throughput, average removals of TOC, SOC, BOD, color, and suspended solids were 75, 76, 83, BOD, color, and suspended solids were 73, 76, 83, 90, and 86 percent respectively. Pretreatment of the secondary effluent for suspended solids removals was unnecessary, since significant headloss was observed only during periods of activated sludge bulking. A carbon exhaustion of less than 500 lb per million gallons of water treated was established. With thermal reactivation and reuse, this exhaustion rate would be economically feasible especially if the product water could be sold ble, especially if the product water could be sold for industrial reuse. (Lowry-Texas) W72-09845

FOCUS ON WATER POLLUTION ABATE. MENT, A. W. J. Dyck.

American Paper Industry, Vol 51, No. 11, November 1969, p 12-18, 4 fig, 1 tab.

Descriptors: \*Pulp and paper industry, \*Industrial wastes, \*Separation techniques, Reverse osmosis, Membrane processes, Sedimentation, Coagulation, Precipitation (Chemical), Biodegradation, Turbidity, Fibers (Plant), Suspended solids, Colloids, Dissolved oxygen, Research and development, \*Waste water treatment.

The pulp and paper industry has spent nearly \$350,000,000 in capital investment in water pollu-tion control, with the result that about 90% of all mills practice some form of effluent treatment. mills practice some form of effluent treatment. The major groups of pollutants dealt with include:

(1) oxygen-demanding wastes, including short fibers, starches, and various other organic additives not retained by the paper sheet; (2) inorganic chemicals and minerals that enter the effluent through sewered white and wash waters; and (3) sediments such as sand, silt, and organic debris. While most mills are equipmed with primary treat. While most mills are equipped with primary treat-ment facilities, only 80% of the suspended solids are setteable, making clarification alone no longer adequate in meeting modern water quality stan-dards. Numerous industries are working to perfect treatment systems for pulp and paper industry wastes, such as Dorr-Oliver, Allis Chalmers, etc., as well as the National Council For Air and Stream Improvement. Reverse osmosis treatment seems to offer considerable promise at present for pulp and paper industry effluent problems, and inten-sive research and development work is continuing. (Lowry-Texas) W72-09846

STUDIES ON THE TOTAL OXIDATION OF AC-TIVATED SLUDGE WITH AND WITHOUT HYDROLYTIC PRETREATMENT, Oklahoma State Univ., Stillwater. School of Civil

Engineering. A. F. Gaudy, Jr., P. Y. Yang, and A. W. Obayashi. Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, Purdue University Engineering Ex-tension Series No. 137, p 342-355, 10 fig, 6 ref.

Descriptors: \*Activated sludge, \*Biodegradation, \*Chemical degradation, \*Hydrolysis, Nitrogen, Pilot plants, Metabolism, Oxidation, Organic loading, Aeration, Sludge, Centrifugation, Separation techniques, Proteins, Phosphorus, \*Waste water treatment, \*Sludge treatment. Identifiers: \*Extended aeration.

A 9.4 liter continuous flow pilot plant was fed a synthetic glucose waste, at a 500 mg/l glucose concentration, providing an organic loading of 50 lb COD/1000 ft3 aeration capacity. The pilot plant was operated as an extended aeration activated aludge system. However, centrifugation was used to ensure that all biological solids were retained, and after three years no significant inactive sludge fraction had been built up which could con-ceivably cause the biochemical failure of the system. Further tests were then conducted on the extended aeration systems with the addition of an acid hydrolysis step for controlling sludge concentrations. This system made ways and means of storing the sludge until biological hydrolysis occurred unnecessary. The system performs chemically a difficult biological function, and biologically a difficult chemical function, with an indicated low cost, high efficiency result. At the same time, other functions such as nutrient adjustment, can be easily performed with only minor system modification. (Lowry-Texas) W72-09848

## AIR FLOTATION TREATMENT AND REUSE OF REFINERY WASTEWATER, Mobil Oil Corp., East Chicago, Ind.

J. A. Hart.

Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, Purdue University Engineering Extension Series No. 137, p 406-413. 3 fig. 4 tab, 1

Descriptors: \*Industrial wastes, \*Water reuse, Separation techniques, Oil, Phenols, Suspended solids, Ammonia, Flotation, Polyelectrolytes, Cooling towers, Slime, "Waste water treatment, Water quality control, Treatment facilities, Indi-

Identifiers: \*Dispersants.

The Great Lakes-Illinois River Basin Survey, conducted in 1963, indicated a need for reduction of pollutants discharged to the Indiana Harbor Ship canal. In response to this survey, Mobil Oil Corporation's East Chicago Refinery has been con-tinually upgrading effluent quality. Major innova-tions or equipment installations for water quality improvement include: (1) installation and opera tion of a sour water stripper (in service since February 1963); (2) installation and operation of an air flotation unit (completed and placed in service April 1969); (3) reuse of treated wastewater in cooling towers (October 1969); and (4) improved in-plant housekeeping practices for minimization of pollutant discharges at the source. These im-provements have resulted in a decrease in the provements have resulted in a decrease in the volume of waste discharged from 1700 gpm to 625 gpm. In comparison with the 1963 levels, discharges of oil, phenols, ammonia-nitrogen, BOD, sulfides and suspended solids have decreased by 96%, 98%, 98%, 81%, 99.9%, and 88% respectively. (Lowry-Texas) W72-49849

DEVELOPMENT AND OPERATION OF AN AERATION WASTE TREATMENT PLANT, Colgate-Palmolive Co., Jeffersonville, Ind. J. L. Herin, L. H. Marlow, and C. T. Stigger.

Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, Purdue University Engineering Extension Series No. 137, p 420-426. 3 fig.

Descriptors: \*Water pollution control, \*Detergents, \*Surfactants, Separated sewers, Activated sludge, Aeration, Foaming, Suspended solids, Sludge disposal, Kinetics, Biochemical oxygen de-mand, Nitrogen, Cost analysis, \*Waste water treatment, Indiana, Treatment facilities.

Treatment of industrial wastes from the Colgate-Palmolive Company's Jeffersonville Plant in an extended aerated activated sludge secondary waste treatment system has been attempted since July 1, 1968. Summer operation of the system was excellent, despite experimentation on the part of plant personnel directed at determining optimum control parameters and loading rates. With the onset of winter conditions, however, difficulties began which have continued up to the present. The began which have continued up to the present. The diversity and complexity of each industrial effluent, and the rapidity with which process changes take place, make industrial waste treatment an extremely difficult and costly problem, both in time and money. An estimated \$1 million has been spent at the Jeffersonville plant, including monies for: (1) in-plant controls; (2) separation of existing sewers into segregated sanitary, process, and storm and cooling water sewers; and (3) construction of the pumping station and the extended aeration treatment plant. Expenditures of another \$350,000 is scheduled in the near future for expansions and additions to the system. While excellent progress has been made, more extensive co-operation and work between the industries, consultants, and the scientists is essential for obtaining optimum progress in pollution abatement.
(Lowry-Texas)
W72-09850

WASTEWATER TREATMENT FACILITIES AT WASTEWATER TREATMENT TO THE EDMONTON, ALBERTA PLANT OF BUILDING PRODUCTS OF CANADA LIMITED, Building Products of Canada Ltd., Montre (Quebec). J. P. Hartley.

Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, Purdue University Engineering Ex-tension Series No. 137, p 414-419. 2 fig, 2 tab.

Descriptors: \*Pulp and paper industry, \*Pulp wastes, \*Water reuse, Industrial wastes, Water wastes, Waster feuse, Industrial wastes, wastes, wastes, Consumption, Sedimentation, Aeration, Mixing, Biochemical oxygen demand, Oil, Suspended solids, Phenols, Design criteria, Dissolved oxygen, Cost analysis, \*Waste water treatment, Treatment facilities, \*Canada.

Identifiers: \*Edmonton (Canada).

Mounting pollution in the North Saskatchewan was of sufficient concern to Building Products Limited of Canada's Edmonton Plant management to warrant initial process improvements for pollu-tion reduction, such as reduced water consumption and better fiber recovery in the savealls. Since only limited improvement could be obtained in this manner, a consulting firm was engaged to perform a waste characterization study and to make recommendations for treatment. The recommended system included a circular clarifier for suspended solids removal in addition to a detention lagoon for aeration and BOD removal. Helixor compressed air aerators were selected due to the rigors of the freezing winter climate, as well as for their excellent aeration and mixing capabilities. Sedimentation time in the clarifier is 3 hours and in the lagoon is 20 days. Oil is skimmed from the surface for collection and tank truck disposal. Average BOD, COD, and suspended solids removals have been 75-80, 80, and 80% respectively. Total system cost was \$200,000, or \$2000/daily ton for the 100-ton/day pulp mill. Further reuse possibilities for the treated effluent are being investigated. (LowDEVELOPMENT OF WASTE OIL RECOVERY PROCESSES AT ARMCO STEEL CORPORA-TION,

Armco Steel Corp., Middletown, Ohio. V. W. Foltz.

Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, Purdue University Engineering Ex-tension Series No. 137, p 314-321. 5 fig.

Descriptors: \*Oil wastes, \*Lubricants, \*Emulsions, \*Separation techniques, Laboratory tests, Pilot plants, Polymers, Filtration, Flotation, Skimming, Design criteria, Mixing, \*Waste water treatment, Industrial wastes, Treatment facilities, \*Okio Identifiers: \*Middletown (Ohio).

Loss of surplus coating oils, discarding of spent rolling lubricants, and leaking hydraulic systems may generate several thousand gallons/day of waste oils at facilities such as Armco Steel Corwaste oils at ractines such as Armoo Steel Cor-poration's Middletown, Ohio plant. Successful laboratory and pilot scale investigations of a clarification scheme for recovering mineral oil leaked from scale-breaking and welding equip-ment, prompted construction of a plant scale system. The system consists of initial clarification, system. The system consists of initial characteristics of followed by flow equalization in a sump, polymer addition, three-stage clarification, and filtration. 300 to 400 gal/day of hydraulic oil have been recovered, containing 0.01% water and 0.02% solids, suitable for reuse. Treatment schemes for solids, suitable for reuse. Treatment schemes for water containing oil, solids and surfactants, and water containing oil, fats, solids, and chemical emulsifiers are also presented. All three processes depend on organic polymers to some extent, and together these systems are responsible for reclaiming between 800 and 1100 gal/day of usable oils which would otherwise be uselessly polluting the environment (Lowry-Texas) environment. (Lowry-Texas)

THE ROLE OF SURFACE CHEMISTRY IN THE REMOVAL OF COLLOIDAL POLLUTANTS BY

MICROFLOTATION, Clarkson Coll. of Technology, Potsdam, N.Y. E. A. Cassell, E. Matijevic, F. Mangravite, Jr., T. M. Buzzell, and S. B. Blabac.

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 Price \$0.35. Office of Saline Water Research and Development Progress Report No. 760, March 1972. 24 p. 7 fig. 27 ref. OSW 14-01-0001-1672.

Descriptors: \*Flotation, \*Foam separation, \*Water treatment, \*Colloids, Waste water treatment, Hydrogen ion concentration, Water pollution treatment. Identifiers: \*Microflotation, \*Colloidal silica, Polystyrene.

A wide variety of different colloids can be effectively separated from water by microflotation under similar conditions of pH and aluminum salt concentrations. Microflotation has sufficient ver-satility to accomplish simultaneously the removal of the mixtures of colloidal pollutants commonly found in natural and waste waters such as humic acid, colloidal silica systems, particles of latex and bacterial cultures. (OSW)

GAMMA RADIATION OF TEXTILE WASTE-WATER TO REDUCE POLLUTION, Auburn Univ., Ala. Water Resources Research

J. F. Judkins, Jr., L. J. Hirth, R. H. Dinius, and J.

Available from the National Technical Informa-Available 110th the National Technical Information Service as PB-210 197, \$3.00 in paper copy, \$0.95 in microfiche. Alabama Water Resources Research Institute Bulletin No. 6, 1972, 49 p, 11 fig, 8 tab, 18 ref. OWRR A-012-ALA (3).

Descriptors: \*Textiles, \*Bleaching wastes, \*Irradiation, Cobalt, Dyes, Chemical oxygen demand, Hydrogen ion concentration, Color,

### **Group 5D—Waste Treatment Processes**

Neutralization, Activated carbon, Adsorption, Laboratory tests, Industrial wastes, Waste water treatment. Identifiers: \*Starch.

A two-phase laboratory study of textile waste treatment by gamma radiation from a Cobalt-60 source was conducted. Laboratory prepared dye samples, starch solutions, starch desize solutions, and PVA desize solutions were exposed to various dosages of radiation and the corresponding reductions of color, COD, BOD, and pH were moni-tored. Decolorization of certain diazo dyes ap-peared to be attainable at a dosage of 24,000 rads. Although the irradiation process efficiency (G value) for COD reductions for concentrated solutions (COD approx. 10,000 ppm) was greater than 100, the G values for dilute solutions (COD approx. 50 or 100 ppm) were around 20. Previous work has established 100 as the G value necessary for successful radiation treatment. The second phase of the investigation involved modification of the procedure to include additions of various metals and activated carbon. Metals were found to both increase and decrease G values, depending upon the waste used, but activated carbon addition resulted in G values for all systems which were of the order previously specified for economical application of irradiation treatment. (Lowry-Texas) W72-09924

LIVESTOCK WASTE MANAGEMENT AND POLLUTION ABATEMENT.

For primary bibliographic entry see Field 05G. W72-09940

SYSTEMS FOR THE DEHYDRATION OF LIVESTOCK WASTES: A TECHNICAL AND ECONOMICAL REVIEW, H. G. Scholz.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971. p. 27-29, 5 fig, 2 tab.

Descriptors: \*Farm wastes, \*Biological treatment, Aerobic treatment, Anaerobic digestion, Swine, \*Dehydration, Drying, Liquid wastes, Poultry, Wastes water treatment, Economics. Identifiers: \*Humus manure.

Both biological decomposition and incineration result into a final product which is not marketable. On the other hand, dehydration followed by pulverization of livestock wastes offers the possibility of a product which can be bagged and sold as soil amendment. It is even possible, under European conditions, to have the returns from such a system redeem the capital and operating cost of the plant. Such a system has been designed and is in operation in Europe. In this system, wastes are homogenized and then conveyed to a rotary drum drier. Moisture is removed, and the dried material is conveyed to a cyclone and baged. Flue gas is scrubbed by pumping fresh liquid manure from the building into a verturi scrubber. Manure, heated through contact with the flue gas, falls, into a storage tank which is also used to aid in reducing the moisture content of the manure. The contents of the tank are mixed thoroughly to increase the evaporation surface area of the liquid. This mixing also helps homogenize the manure before it is pumped into the rotary drum. Wastes from poultry, dairy cattle and swine need be treated dif-ferently before the drying takes place. Different designs incorporating such pretreatments are described and illustrated with photos. (See also W72-09940) (Bundy-Iowa State)

A LAND RECYCLING LIQUID MANURE SYSTEM FOR A LARGE-SCALE CONFINE-MENT OPERATION IN A COLD CLIMATE, Department of Agriculture, Ottawa (Ontario). Engineering Research Service. J. E. Turnbull, F. R. Hore, and M. Feldman.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 39-43, 2 fig., 6 tab., 4 ref.

finement pens, Odor, Cattle, Liquid waste, Air pollution, Water reuse.

pollution, Water reuse. Identifiers: Sluice-gate recirculation system, Plow-cover injector system.

A full-scale liquid manure system is described for the confined housing of approximately 800 dairy cattle, 1,500 sheep, and 40,000 poultry situated on a 2,800 acre animal research site adjacent to suburan housing near the city of Ottawa. The system is based on the established practice of recycling animal wastes to cropland. Through design, planning and management, the system comes v close to meeting presently accepted criteria for the control of water, air and soil pollution. The system contains a total of six-months storage capacity to avoid the potential for water pollution from winter land application of manure. Waste removal from trench storage in cattle and sheep barns is assured by use of the European hydraulic flushing system, and conventional scraping is used for poultry.

Manure is held in storage under quiescent, low
odor conditions. When manure is agitated for removal from storage, some odor is produced at the building site and a nuisance potential is created. However, site planning makes this potential problem practically non-existent since adequate space separation between the barns and surrounding neighbors was provided. Enclosed tankers control odors during transport and by applying the principle of rapid soil cover of manure. a relatively odor-free method of land disposal is achieved. The development of an inexpensive hooded tanker outlet which directs manure downward in a four-foot wide swath allows a tractor and plow to straddle and cover the manure in several seconds. Manure application rates do not exceed presently accepted levels for soil pollution control. (See also W72-09940) (Bundy-Iowa State)

MANAGEMENT OF BARNLOT RUNOFF TO IMPROVE DOWNSTREAM WATER QUALITY, Ohio Agricultural Research and Development

Center. Wooster.
For primary bibliographic entry see Field 05G.

W72-09952

FEEDLOT MANURE MANAGEMENT IN A DESERT CLIMATE, California Univ., Davis. Dept. of Agricultural En-

S. R. Morrison, G. P. Lofgreen, and T. E. Bond. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium

on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 60-61, 2 fig., 2 tab., 8 ref.

Descriptors: \*Farm wastes, Odor, Dust, Nitrogen, Lagoon, Sludge disposal, Evaporation, Aerated lagoons, Sprinkler irrigation. Identifiers: \*Anaerobic lagoon, Imperial Valley (Calif).

Manure management problems are somewhat different in desert climates from those in regions with higher rainfall, and in some respects are less severe since runoff is not likely to cause stream pollution. More usual problems are impairment of human environment due to dust, odors, and flies; manure disposal without available cropland; and cattle performance impaired by muddy lots in winter and heat and dust in summer. To overcome these problems in the Imperial Valley of California a system using slatted floors, anaerobic pits, aeration lagoons, and a sludge disposal area is under investigation. Initial tests were done to determine the effect of loading rate on decomposition of organic matter and nitrogen, and the surface area required for evaporation of liquid wastes. Two 210-day tests have been completed using standard feedlot practices and animals on a 90 percent con-centrate ration. Reduction of organic matter generally increased with decreasing loading rate, with about 70 per cent being lost at 0.023 lb/day/ft3. About 50 per cent of the nitrogen was removed at this loading rate. A surface area of 50 sq. ft. per animal was sufficient to evaporate the water from the waste. The cattle performed satisfactorily on the slatted floors, which had also functioned well in tests of a sprinkling system for heat-stress relief. (See also W72-09940) (Bundy-Iowa State)

ANALYSIS OF DUCK FARM WASTE TREAT-

MENT SYSTEMS,
D. D. Schulte, and R. C. Loehr.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971. p. 73-76, 9 fig., 8 ref.

Descriptors: \*Farm wastes, Model studies, Aerated lagoons, Phosphorus, Biochemical oxygen demand, Water consumption, Waste treatment, Ducks (Domestic), \*Dynamic programming, Mathematical models.

In order to establish a rational basis upon which alternative duck farm waste water treatment systems could be evaluated, a mathematical model was developed. This model provided a structure in which the effect of the following items on the total annual cost of wastewater treatment could be considered: (a) capital costs of land and equipment; (b) interest and amortization rates; (c) operating costs of equipment and chemical costs; (d) treat-ment requirements for BOD, phosphorus, and suspended solids; (e) treatment system design; and (f) operational decisions such as water use rate and duck population. The efficiencies of three treatment alternatives, (plain sedimentation, chemical precipitation, and aerated lagoons), were established through bench scale tests and from mathematical equations and published informa-tion. Application of this model to a particular duck farm demonstrated the feasibility of using an cal models for agricultural waste management. In-formation available from this kind of approach provides a sounder basis for decision maki results of this project, which was completed in June of 1970, will be used as an example of how mathematical models can be applied to prob of agricultural waste management. (See also W72-09940) (Bundy-Iowa State) W72-09959

MULTISTAGE LAGOON SYSTEMS FOR TREATMENT OF DAIRY FARM WASTE. Florida Univ., Gainesville. Dept. of Agricultural Engineering.

R. A. Nordstedt, L. B. Baldwin, and C. C.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 77-80, 7 tab., 8 ref.

Descriptors: \*Farm wastes, \*Sprinkler irrigation, Lagoons, Cattle, Biochemical oxygen demand, Groundwater, Water pollution, Aerobic lagoons, Nitrogen. Identifiers: \*Dairy, Multistage lagoons, Anaerobic

The objectives are to (1) determine the design and operational parameters for treatment of dairy farm waste by multistage lagoon systems in arcas warm climates, sandy soils and high water tables, (2) determine the groundwater pollution potential from this type of system and any necessary cor-rective measures, and (3) determine the effects of the effluent from this type of system on a seepage irrigated pasture. A multistage lagoon system has been designed and constructed on a 600-cow dairy farm. The system consists of one anaerobic ar two aerobic lagoons in a series arrangement. The efflent from the third lagoon flows by gravity into a 40macre seepage irrigation system in permanent pasture. Influent and effluent of each lagoon is sampled in two week intervals. Test wells are located at 15, 50 and 100 foot intervals from the bic lagoon and at 15 and 100 foot interval from the second lagoon. Water is drawn from 30 sampling tubes in the seepage irrigated pasture at three week intervals. Results from the first five three week intervals. Results from the first five months of operation indicate an average influent BOD of 543 mg/l. at a flow of approximately 60,000 gallons per day. BOD reductions of 89%, 54% and 8% in the first, second and third lagoons, respectively, have been achieved for a total reduction of 95%. (See also W72-09940) (Bundy-Iowa State) W77-09960

SOLVING THE POULTRY MANURE PROBLEM ECONOMICALLY THROUGH DEHYDRATION, Pennsylvania State Univ., University Park. Dept.

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Pennsylvana State Univ., University Park. Dept. of Poultry Science.
G. O. Bressler, and E. L. Bergman.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 81-84, 3 fig., 5 tab.

Descriptors: \*Farm wastes. Anaerobic conditons. Odor, Drying, Poultry, Bacteria, Economics, Dehydration, Air pollution, Water pollution. Identifiers: \*Heater dryer, High velocity air, Time clock, Two-stage system.

Poultry manure handling is a two-pronged problem, high moisture content and anaerobic bacterial activity causing obnoxious odors. The objectives were 1) to remove as much moisture as possible from the poultry manure inside the poultry house to lessen the weight of the material to be handled; 2) to eliminate odors and flies; and, 3) to devalve a subtemptic vertex of massia handling. handled; 2) to eliminate odors and flies; and, 3) to develop an automatic system of manure handling to eliminate manual labor. A two-stage drying system achieving these objectives has been developed. Stage 1 drying occurs inside the poultry house by application of high velocity air to the manure and stirring the manure frequently. In this stage manure is dried to about 30% moisture, which is 1/3 of the original weight and it is relatively free of abovations does because odor producing ly free of obnoxious odors because odor producing bacteria are destroyed. Movement of air at high bacteria are destroyed. Movement of air at high velocity (500 feet per minute) is accomplished by operating continuously 20-inch fans spaced about 35 to 40 feet apart lengthwise to the manure bays or pits inside the poultry house. Stirring is accomplished with a specially designed rake and cleaning device which turns, churns, tumbles, and mixes the poultry droppings as they fall to the floor underneath the birds. The dry, powdery product is free of obnoxious odors, has shelf life, and is in a form acceptable for merchandising as an organic form acceptable for merchandising as an organic Income now being received for this product exceeds the costs of Stage 1 and 2 drying methods. (See also W72-09940) (Bundy-Iowa State) W72-09961

## A FARM SCALE DAIRY WASTE DISPOSAL

Washington State Univ., Pullman. D. O. Turner, and D. E. Proctor.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 85-88, 4fig., 4 tab., 6 ref.

Descriptors: \*Farm wastes, Cattle, Sprinkler irrigation, Confinement pens, Lagoons, Nitrogen, Rotations, Waste disposal, Waste storage, Crop response, Washington. Identifiers: \*Large annual rainfall, Plastic irriga-

Livestock wastes from beef feed lots and from the dairy cattle industry are produced in large quanti-ties in small areas. A systems approach to waste disposal has been developed by Washington State

University in conjunction with the Washington State Department of Institutions' Honor Farm at Monroe. This system uses a covered confinement area to exclude excessive rainfall; a collection and transfer system to move wastes from confinement areas to storage lagoons; and pipeline and sprinkler systems to move wastes from confinement areas or lagoons to areas of ultimate disposal by field application. Animal waste from a herd of 250 mature Holsteins is scraped, flushed, and transported with minimum water into two 1,000,000-gallon capacity lagoons where it is held in winter storage for field distribution during the growing season. The organic degradation and nutrient recycling capability of soil as a receiver of wastes, coupled with seasonal application, appears to be the key to such waste disposal. Loading levels are being defined under field conditions. Crops understudy are silage corn, cereal rye for greenchop, area to exclude excessive rainfall; a collection and study are silage corn, cereal rye for greenchop, and grass legume pastures, as these crops complement dairy operations and tend to recycle nitrogen. Measurements are being taken of distribution patterns by the sprinklers, infiltration rates, bacteria survival, nitrate-nitrogen concentrations in the forage and through the soil profile to a 4-foot depth, BOD counts, botanical composition of forage stands, and crop yields. (See also W72-09940) (Bundy-Iowa State) study are silage corn, cereal rye for greenchop,

### A TOTAL BIOCHEMICAL RECYCLE PROCESS

FOR CATTLE WASTES, Babson Bros. Co., Elmhurst, Ill. Environmental

L. G. Carlson

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 89-91. 3 fig, 5 ref.

Descriptors: \*Farm wastes, Cattle, Liquid wastes, Phosphates. Proteins, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Potassium, Microorganisms.

Identifiers: \*Babson Biochemical Process, Reac-

The Babson Biochemical Process accepts cattle wastes, such as liquid manure, and recovers undigested solids, as washed and cleaned particulate matter, from a counter-current classification tower. The solids are pelletized into slugs two inches in diameter and one-half inch thick. The remaining liquid, consisting of suspended solids, dissolved solids, and some colloidal matter, is pumped to a Reaction Tower, Reaction Ves pumped to a reaction rower, Reaction vessels, and Enzyme Vessel complex, wherein, bubbles are formed as a function of the rate of mass transfer, and is key to this biochemical process. The residence time is a few hours with partial recycle to keep enzymatic activity high. Recovery of activity is very rapid, even after several weeks in the endogeneous phase. The effluent is then sent to a flocculation/coagulation (F/C) system, where phosphates, proteins, polysaccharides, metal ions, etc. are removed, dried, and fortified to make a fertilizer which is slow to dissolve. The liquid effluent from the F/C vessels is then de-ionized and decolorized, and used for drinking water, or partially de-ionized, and used for corral flushing of manure into a common pit. (See also W72-09940) (Bundy-Iowa State) W72-09963

# AMMONIA DESORPTION FROM CONCEN-

AMMONIA DESORPTION FROM CONCENTRATED CHICKEN MANURE SLURRIES, Agricultural Research Service, Ithaca, N.Y. Agricultural Engineering Research Div. A. G. Hashimoto, and D. C. Ludington. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 117-121, 3 fig, 5 tab, 7 ref.

Descriptors: \*Farm wastes, \*Nitrogen, \*Ammonia, Poultry, Hydrogen ion concentration.
Identifiers: \*Chicken manure, Fick's Second Law.

The purpose was to determine the parameters affecting ammonia desorption from concentrated chicken manure slurries and to develop an equation to predict the rate of ammonia desorption. Analyses of variance were performed to determine whether any correlation existed between the desorption rate constant and the fraction of undissociated ammonia, (Fu), temperature, air flow, total and volatile solids, initial organic nitrogen concentration and initial ammonia nitrogen concentration. Preliminary analysis indicates that only Fu and temperature have significant correlation with the desorption rate constant under the experimental agitation rates and geometric shape of the reaction vessel. The desorption rate constant may be predicted by an equation of the following form: K/I-Fu = A (T/I-Fu)B where: K = ammonia desorption rate constant (hour-1); T = temperature (deg. F); Fu = fraction of undissociated ammonia; A and B = constants. The amount of base required to maintain the desired pH was recorded to determine which pH range might be the most efficient in stripping ammonia. Below pH 10.0 there is a direct relationship between the ratio of base required to ammonia removed and pH. Above pH 10.0 the ratio is independent of pH. (See also W72-09940) (Bundy-Iowa State)

# ANTIBIOTIC RESISTANCE AND RESISTANCE TRANSPER BETWEEN BACTERIAL ISOLATES IN A WASTE LAGOON, North Dakota State Univ., Fargo. Dept. of Bac-

North Dancia Co.

M. Bromel, Y. N. Lee, and B. Baldwin.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 122-125, 2 fig, 6 tab, 11 ref.

Descriptors: \*Farm wastes, Liquid wastes, Salmonella, Microorganisms, Cattle, E. coli, Public health, Pathogenic bacteria, Transfer. Identifiers: \*Public health hazard, R factors.

The incidence and pattern of antibiotic resistance in bacterial isolates from liquid and solid bovine wastes and from the Red River of the North were wastes and flow the text where of the North were determined by disc assay and tube dilution methods. Subsequent in vitro mating experiments were performed between the enteric members of these two groups of isolates so that the patterns of antibiotic-resistance transfer could be elucidated. Levels of antibiotics present in waste lagoon water and river water were determined by microbiologi-cal assay. Complete resistance to aureomycin, terramycin sulfamethazine and sulfaethox-ypyridazine was shown by isolates of the genera Salmonella, Proteus, Streptococcus and Escherichia. Developing antibiotic resistance was shown by isolates of the teneral Shigella and Klebsnown by isolates of the teneral singeria and kleb-siella. Drug sensitivity was shown only by clos-tridial isolates. Successful transfer of multiple drug resistance to sulfamethazine, penicillin and strepromycin was obtained from a Proteus sp. to an Escherichia sp. Results from the matings of the an Escherichia sp. Results from the matings of the recombinants with drug-sensitive typhoid and dysentry organisms are reported. In some instances, detectable levels of terramycin and aureomycin were found in waste waters. The possibility for drug resistance transfer between organisms in livestock wastes and pathogens in public waters was significantly high and constitutes a potential public health hazard. (See also W72-09940) (Bundy-lowa State) W72-09973 W72-09973

### AGITATION IN LIQUID MANURE TANKS, Tennessee Univ., Knoxville. Dept. of Agricultural Engineering.

J. I. Sewell.
In: Livestock Waste Management and Pollution
Abatement, Proceedings International Symposium
on Livestock Wastes, Ohio State University, April
19-22, 1971, p 135-137, 4 fig. 1 tab. 5 ref.

Descriptors: \*Farm wastes, Model studies, Liquid wastes, Pumps, Slurries, Design, On-site tests, Cattle, Mixing.

### **Group 5D—Waste Treatment Processes**

Few problems with agitation were encountered in two full-scale field tests of liquid manure systems at dairies. Adding water to the tanks immediately after emptying greatly facilitated agitation. As the quantity of waste hay, silage, and green chop en-tering the pits increased, agitation became more tering the pits increased, agitation became more difficult. Scraping manure into the tanks before appreciable drying had occurred also facilitated agitation. Minimizing the entry of twine, wood chips, and coarse hay into the pits reduced downtime. While the results of the model studies suggested that best agitation could be achieved in pits equipped with side and center baffles, effective agitation was achieved in pits constructed. tive agitation was achieved in pits constructed with cover support columns and without baffles. with cover support columns and without battles. As the model studies suggested, cover support columns did not adversely affect agitation. In designing liquid manure pits where agitation difficulties are expected, center and side baffles should be considered. (See also W72-09940) (Bundy-Iowa State) W72-09977

AUTOMATED HANDLING, TREATMENT AND RECYCLING OF WASTE WATER FROM AN ANIMAL CONFINEMENT PRODUCTION UNIT, Ohio State Univ., Columbus. Dept. of Agricultural Engineering.

E. P. Taiganides, and R. K. White.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 146-148, 4 fig. 3 ref.

Descriptors: \*Farm wastes, Confinement pens, Oxidation, Odors, Dusts, Aerobic treatment, Biological oxygen demand, Waste water treat-Biological oxygen demand, waste water dear-ment, Water reuse, Hogs. Identifiers: \*Automatic flushing, Flushing tanks, Solids separator, Fuch's oxygenator.

Manure is flushed out by flooding the gutters of a confinement building where 500 pigs are raised from 20 to 220 lbs. This way no labor is needed to scrape the manure out plus no offensive odors are released into the building because of frequent flushing. The flushed wastewater is pumped onto a screen which separates the solids from the liquid. The solids are aerobically digested, deodorized and stored before final disposal onto agriculturally productive land. The liquids separated at the screen are discharged into an oxidation ditch. Ditch effluent is clarified and the supernatant is pumped back into the building as flushing water. Provisions to disinfect the recycled water for odor and disease control are present in the system. Laboratory-scale model was tested to arrive at Laboratory-scale model was tested to arrive at maximum loading rates for odor control. Four loading rates ranging from 30-80 lbs VS/1000 ft/day were tested. Preliminary results show thourly loading is better than daily slug loading. All loading rates can be effective, but the higher rates require closer supervision. Odors given off are ammonia-like at first but change to earthy or musky inoffensive odors after the 6th day. Foaming was much greater with slug loading. However, the set-tling characteristics of the slug-load unit were better than hourly-loading. (See also W72-09940) (Bundy-Iowa State) W72-09980

MANURE MANAGEMENT IN A 700-HEAD SWINE-FINISHING BUILDING; TWO AP-PROACHES USING RENOVATED WASTE

WATER, Iowa State Univ., Ames. Dept. of Agricultural En-

For primary bibliographic entry see Field 05G.

HIGH RATE POULTRY MANURE COMPOST-ING WITH SAWDUST, North Carolina State Univ., Raleigh. Dept. of Civil

Engineering.

M. S. Galler, and C. B. Davey.
In: Livestock Waste Management and Pollution
Abatement, Proceedings International Symposium

on Livestock Wastes, Ohio State University, April 19-22, 1971, p 159-162, 9 fig, 2 tab, 2 ref.

Descriptors: \*Farm wastes, Poultry, Aerobic treatment, Carbon, Nitrogen, Grains, Cation exchange, Crop response, Waste treatment. Identifiers: \*Composting, Sawdust.

The feasibility of high rate, thermophilic composting of animal wastes mixed with carbonaceous materials and the affect of the compost on plant growth were investigated. Poultry manure and awdust were initially selected in order to get the proper moisture content and carbon to nitrogen ratio (C:N). Each batch was characterized chemiratio (C:N). Each batch was characterized chemically in order to determine the moisture content, the proper C:N and available phosphorus, potassium, calcium, and magnesium. Sixteen batch studies were made using a 45 cubic foot rotating drum approximately two-thirds full. The composting mass was aerated continuously. The effects of aeration, agitation, C:N, and moisture content were studied. The pH, temperature, and oxygen uptake were studied for each run. Mass balances were made to determine nitrogen losses. Cellulose were made to determine nitrogen losses. Cellulose degradation was also studied. After removal from degradation was also studied. After removal from the composter, cellulose degradation took place as a fungus developed in the pile. The cellulose content decreased during the storage phase by over 25% in four to six weeks while the cation exchange capacity rose from 35 milli-equivalents per 100 grams to 67 milli-equivalents per 100 grams. Nitrogen losses for the properly run process averaged about 3.5%. The final product had a blackish-white color and an odor resembling a fresh humus soil Greenhouse studies were made. fresh humus soil. Greenhouse studies were made using tomatoes, wheat, millet and greenbeans. The plants were planted in soil compost mixture ranging from 0% to 100% compost by weight. (See also W72-09940) (Bundy-Iowa State) W72-09983

COMPOSTING DAIRY COW WASTES, Agricultural Research Service, Beltsville, Md. Livestock Engineering and Farm Structures Research Branch. For primary bibliographic entry see Field 05G.

WATER HYACINTHS TO FURTHER TREAT ANAEROBIC LAGOON EFFLUENT, Iowa State Univ., Ames. Dept. of Agricultural Engineering.
J. R. Miner, J. W. Wooten, and J. D. Dodd.

In: Livestock Waste Management and Pollution Abatement, Proceedings, International Symposi-um on Livestock Wastes, Ohio State University, April 19-22, 1971. p 170-173, 4 fig, 7 tab, 10 ref.

Descriptors: \*Farm wastes, Water hyacinth, Aero-bic treatment, Oxidation lagoons, Nitrogen, Phosphorus, Chemical oxygen demand, Waste water treatment. Identifiers: \*Anaerobic lagoon effluent.

Effluent from an anaerobic lagoon treating liquid swine manure was pumped through a series of four pools, each ten feet in diameter. Water hyacinths pools, each ter leet in diameter. Water hyacintis were grown on these pools in an effort to provide further treatment. The plants flourished, necessitating weekly harvesting of one-fourth of the growth. During the month of July 1970, nine pounds of ammonia were added to the system in the influent and less than one-fourth pound discharged in the effluent. During this same period, 28 pounds of COD were added and 2.6 pounds discharged. Extrapolating the system to a per acre basis indicates ammonium nitrogen removal to be in excess of 35 pounds per acre per removal to be in excess of 35 pounds per acre per day, COD removal to exceed 100 pounds per acre per day and phosphate removal to exceed 15 pounds per acre per day. Nitrate release was less than 0.3 pounds per acre per day. In one sample weekly harvest (Aug. 14 Aug. 21), 450 plants with a total wet weight of 90 lbs. were removed from two of the ponds having a combined area of ap-proximately 160 sq. ft. This corresponds to an increase of over 17,000 new plants per acre per day and an increase in wet weight of over 2500 pounds per acre per day. At a 4% dry weight conversion factor, this equals 100 pounds of dry weight per acre per day. The system has performed satisfac-torily showing potential as a means of removing nutrients from partially treated animal wastes which are not removed by currently used processes. (See also W72-09940) (Bundy-Iowa State) W72-09986

ENZYME-FACILITATED MICROBIAL DECOMPOSITION OF CATTLE FEEDLOT MANURE,
Colorado State Univ., Fort Collins, Dept. of stresti stresti on the dr ste sie pe ac pa ve of Pr tu (S W

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Colorado State Univ., Fort Collins. Dept. of Microbiology.
G. K. Elmund, S. M. Morrison, and D. W. Grant.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971. p 174-175, 4 fig, 7 ref.

Descriptors: \*Farm wastes, Cattle, Feed lots, Enzymes, Biochemical oxygen demand, Microbial degradation, Amino acids, Proteins. Identifiers: \*Enzymatic hydrolysis.

The cleavage of the macromolecular fraction is a rate-limiting step preceding its oxidation or as-similation during the initial microbial decomposi-tion of cattle feedlot manure. Increasing the initial tion or cattle receipt manure. Increasing the initial rate of hydrolysis of the macromolecules may stimulate the development of a microflora actively involved in the subsequent stages of the decomposition process. Methodologies have been developed to evaluate and optimize conditions for any matrix by drollysis of manure substrates and enzymatic hydrolysis of manure substrates as well as bioassay techniques to measure the resultant in-creased rates of microbial activity. The results of studies with proteolytic enzymes are presented as a model system. Fresh manure from feedlot cattle receiving a high concentrate ration was ex-haustively dialyzed, lyophilized and ground in a Waring blender. The non-dialyzable manure components contained 94 percent of the dry matter of fresh manure. The material contained 275 mg/gm protein of which 75 mg/gm was soluble protein. After three hours incubation with Pronase B grade (Calbiochem), essentially all of the soluble and 17.5 percent of the insoluble protein was hydrolyzed. Enzymatic hydrolysis of the protein fraction of feedlot manure appears to significantly increase the initial rate of microbial oxidation of the manure substrate. The results give promise to the use of hydrolytic enzymes to facilitate the overall rate of manure decomposition. (See also W72-09940) (Bundy-Iowa State) W72-09987

THROUGH-CIRCULATION DRVING OF MANURE IN SUPERHEATED STEAM, Drexel Univ., Philadelphia, Pa. Dept. of Chemical Engineering.

J. R. Thygeson, E. D. Grossmann, and J.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 185-189. 7 fig, 1 tab, 6 ref.

Descriptors: \*Farm wastes, \*Drying, Odor, Moisture content, Waste treatment, Waste disposal, Steam. Identifiers: \*Superheated steam, Continuous con-

Treatment of livestock waste to produce a biochemically stable and odor free product capablochemically stable and door free product capa-ble of use as a feed additive, soil conditioner, or fuel is described. The process involves the drying of a packed bed of wet manure extrusions in a closed cycle system employing superheated steam as the drying medium. The prospective advantages of this method of waste treatment include: (1) high production rate per unit area of plant; (2) minimum environmental pollution associated with the

process; (3) relative insensitivity to changes in environmental and feed conditions; (4) capability of treating the undiluted manure; (5) production of a stable, odorless, free-flowing solid convenient for storing or transporting. Preliminary experimental studies on the extrudability of the wet manure and on the pressure drop and drying characteristics of the packed bed indicate that the material can be dried successfully in a through-flow system. The steam was forced through the bed of wet extrusions in a laboratory-scale test apparatus which permitted easy removal of the test section for periodic weighing. The equipment was capable of achieving the following limits on the drying parameters: bed depth of 9 inches; superficial velocity of 1000 feet per minute; fluid temperature of 350 deg F; superheat equivalent to 140 deg F. Provision for pressure drop, flow, and tempera-Provision for pressure dop, flow, and temperature measurement was incorporated in the system. (See also W72-09940) (Bundy-Iowa State) W72-09941

PYROLYSIS OF LIVESTOCK WASTES, Ohio State Univ., Columbus. Dept. of Agricultural

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Descriptors: \*Farm wastes, Anaerobic conditions, Poultry, Swine, Cattle, Thermal capacity, Odor, Waste treatment, Incineration. Identifiers: \*Pyrolysis.

Pyrolysis is the 'anaerobic' incineration of wastes in contrast to combustion which might be termed 'aerobic' incineration. Pyrolysis is the chemical decomposition of materials heated to high temperatures in the absence of free oxygen. Animal manures were heated to 800 deg C at a controlled rate and in an airtight vicor tube placed inside a standard muffle furnace. The released gases were collected by displacing a bring solution and their collected by displacing a brine solution and their collected by displacing a brine solution and their composition was determined by a standard burrett gas analyzer. Quantities of gas produced and their average composition are tabulated. Advantages of pyrolysis include the production of gases which can be reclaimed for heat energy and a dry and innocuous residue product with reduced volume. (See also W72-09940) (Bundy-Iowa State) W72-09992

DRYING POULTRY WASTE,

DRYING POULTRY WASTE, Michigan State Univ., East Lansing. Dept. of Agricultural Engineering.
T. C. Surbrook, C. C. Sheppard, J. S. Boyd, H. C. Zindel, and C. J. Flegal.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 192-194. 4 fig, 4 tab, 5 ref.

Descriptors: \*Farm wastes, Odor, Drying, Proteins, Poultry, Potassium, Phosphorus, Tem-perature, Time, Storage. Identifiers: Pneumatic drying process, High temperature drving.

Experiments were conducted to evaluate a comnutrient losses in the resulting product. The output of this machine was 340 pounds per hour of dried of this machine was 340 pounds per hour of dried poultry waste. Drying is a potential way of handling poultry wastes from an economic standpoint. The final product, dried poultry waste, is in a form which can be easily handled. Samples of dried poultry excreta show a wide (11-38 percent) variation in protein content. From 50 to 65 percent of the available protein remains in the dried poultry waste. Trials were conducted to relate rotein less to the amount of heat as measured at protein loss to the amount of heat as measured at one point in the drier. In temperature ranges from 450 deg to 700 deg F, there was a range of three percent on a dry basis from the same unprocessed waste. Generally speaking, the low range of temperatures were less destructive of protein. There is a relationship between protein loss and storage time. This is not evident for 14 days or less storage time. Protein loss is evident for storage periods of four to six months in commercial poultry houses. (See also W72-09940) (Bundy-Iowa State) W72-09993

ECONOMICS OF WASTE DISPOSAL FROM CONFINED LIVESTOCK, Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics.

W. H. M. Morris.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 195-196. 4 tab, 3 ref.

Descriptors: \*Farm wastes, \*Economic feasibili-ty, \*Waste treatment, Aerobic treatment, Costs, Fertilizers, Nutrients, Waste disposal, Oxidation lagoons. Identifiers: \*Field spreading.

The costs of handling livestock wastes must be considered in the framework of the total production system, and this may change the location, volume, consistency, and composition of the waste. Furthermore, such items as slotted floors and oxidation ditches often comprise a large part of the total cost of a building. Under U.S. conditions, the cost of disposal of livestock wastes expects the cost of livestock wastes expects the livest ceeds their value. No one system of disposal is the least costly or the most profitable under all cir-cumstances. Factors such as the cost of labor and of capital and availability of land in different seasons determine the economically optimal system. No profitable method can be foreseen for dustrial or domestic utilization of any significant part of the livestock waste produced. It is ex-pected that the producer will continue to use the presently available systems of disposal for the foreseeable future. Spreading on land, anaerobic, and aerobic treatment and feeding all seem practical alternatives. The economic choice depends on the species, the environment, and many other factors. (See also W72-09940) (Schmitt-Iowa State) W72-09994

THE ECONOMICS OF SWINE WASTE DISPOSAL,

Environmental Research and Applications, Inc., Wilton, Conn.

R. W. Okey, and S. Balakrishnan.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 199-203. 5 fig, 8 tab, 26 ref.

Descriptors: \*Farm wastes, \*Costs, \*Economic feasibility, Aerobic treatment, Nitrification, Denitrification, Waste treatment, Waste disposal,

Identifiers: Phosphorus removal.

It is desirable to codify and apply research findings from several applicable disciplines and to review the cost/effectiveness ratio of waste treat-ment procedures in the light of new pollution control laws. The essential requirements of treatment are considered to be the total stabilization of carbonaceous and nitrogenous materials with no creation of odors. Possible treatment methods include (1) ground disposal, (2) lagoon storage, (3) total oxidative treatment, (4) organic solids separation and treatment of the liquid stream, (5) primary treatment plus nitrogen and/or phosphorus removal and/or dissolved solids removal. The costs for waste treatment for a 5,000 animal swine system ranged from \$17,600 for a 'solids separation prior to oxidative conversion of ammonia' system to \$35,500 per year for a 'basic oxidation treatment with nitrogen and phosphorus removal' system. If total solids removal was required, the overall management costs of either system would be increased by \$7,300 by adding a membrane system to remove all the inorganics. In addition, a

satisfactory point of ultimate disposal must be found for the solids which were separated out. For small livestock systems, the cost per unit will be increased slightly for most treatments. (See also W72-09940) (Schmitt-Iowa State)

ECONOMIC IMPLICATIONS OF ENVIRONMENTAL QUALITY LEGISLATION FOR CONFINED ANIMAL FEEDING OPERATIONS, Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.

D. D. Badger, and G. R. Cross.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 204-207. 5 fig. 5 ref.

Descriptors: \*Farm wastes, \*Confinement pens, Costs, Regulation, Farm lagoons, Cattle, Hogs, Oklahoma, Waste treatment.

Recently instituted air and water quality standards and resulting State legislation have caused confined animal feeding operators to invest considerably more in construction and operation of their production system. Approaches being used to handle the animal waste and water runoff problem include stockpiling of manure, land spreading, used to oxidation ditches, and use of stabilization ponds. Beef wastes are handled mainly by scraping, loading, hauling, and dumping. Costs for this type of handling are 0.15 to 1.0 cents per pound of gain for sizable feedlots. Hog operations are generally either pasture, feeding flow-no lagoons, slotted or solid feeding floor with adjacent hagoon, or slotted floor with lagoon directly below. Pasture systems had waste handling costs of 0.5 to 0.1 cents per pound of gain, solid feed floor-no lagoon systems had costs of 1 to 0.2 cents per pound, and totally slotted floors had labor costs of 0.5 to 0.3 cents per pound of gain. Implications are that site cents per pound of gain. Implications are that site selection will be much more critical in the future. Increased use of zoning to keep incompatible operations and urban areas separated will be necessary. (See also W72-09940) (Schmitt-Iowa W72-09997

AN OXIDATION DITCH FOR THE HANDLING AND TREATMENT OF POULTRY WASTES, Cornell Univ., Ithaca, N.Y. Dept. of Agricultural

Engineering

R. C. Loehr, D. F. Anderson, and A. C.

Anthonisen.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 209-212, 5 fig, 3 tab, 5 ref.

Descriptors: \*Farm wastes, \*Aeration, \*Aerobic Chemical oxygen demand, Waste storage, \*Waste water treatment, \*Oxidation lagoons.

An oxidation ditch was used to handle and treat poultry wastes from a cage layer operation. The results showed that an oxidation ditch is a reasonable alternative for handling, treatment and disposal of poultry wastes where odor control, liquid waste handling and reduction of the oxygen demand are desirable or necessary goals in a poultry operation. Mixed liquor should not be disposed of in surface waters; however, land disposed of in surface waters; however, land disposal is an acceptable disposal method. There was no overflow from this ditch due to the high evaporation rate. The ditch acted as an aerated holding tank. Total solids exceeded 8% when the holding tank. Total solids exceeded 8% when the ditch was emptied after 274 days of operation. BOD5 was 4200 mg/l and total nitrogen was 3800 mg/l when the ditch was emptied in January 1971. Balances on the system showed 53 percent total solids, 62 percent volatile solids, 83 percent BOD5, 63 percent COD, and 31 percent of the total nitrogen were lost over the 274 day run. The original volume of the ditch was 1200 gallons. To offset 2100 eallors of expansives a total of 2900 offset 2100 gallons of evaporation, a total of 2900

### **Group 5D—Waste Treatment Processes**

gallons of water was added intermittently. After startup, the pH ranged from 5.0 to 6.5. Air flow in the control chamber was 3 to 5 cfm per bird for the 246 birds. (See also W72-09940) (Schmitt-Iowa W72-09999

DESIGN, INSTALLATION AND BIOLOGICAL ASSESSMENT OF A PASVEER OXIDATION DITCH ON A LARGE BRITISH COLUMBIA SWINE FARM,

Department of Agriculture, Abbotsford (British Columbia).

T. A. Windt, N. R. Bulley, and L. M. Staley In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 213-216. 1 tab, 7 fig, 11 ref.

Descriptors: \*Farm wastes, \*Aeration, \*Oxidation lagoons, Hogs, Waste Storage, Biochemical oxygen demand, \*Waste water treatment, Odor. Identifiers: Pasveer ditch.

One 350 to 400 hog unit of a 25,000 commercial swine enterprise was equipped with a Pasveer oxidation ditch. The ditch was a capacity of 3,000 toation ditch. Ine ditch was a capacity of 3,000 cubic feet and is approximately 220 feet long, 3 feet deep, and filled and maintained at a 22 inch liquid level. Hogs were placed in the structure in early June 1970. Foaming occurred about one month after placement and was controlled with an antifoam agent. The oxidation ditch has given complete odor control of the waste. The effluent from the ditch is easily handled by most pumps for final disposal. The cost of operating the 5 horsepower rotor for the ditch was about 25 cents per finished hog, at an electricity cost of 1.1 cents per Kw-hr. The oxygen concentration in the ditch measured at two-week intervals has varied from 3 to 6 ppm oxygen. The theoretical loading rate of volatile solids was based on a value of 5.9 pounds of volatile solids per day per 1000 pounds of live weight. The BOD has ranged from 600 to 2,000 ppm in the oxidation ditch, compared with a BOD value of 40,000 ppm for the raw 2aste. There seems to be a cyclic nature to the quality of contents in the oxidation ditch but this is not completely understood. (See also W72-09940) (Schmitt-Iowa State) W72-10000

BEEF WASTES AND THE OXIDATION DITCH TODAY AND TOMORROW

Minnesota Univ., St. Paul. Dept. of Agricultural

Engineering. R. E. Larson, and J. A. Moore.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 217-219. 4 ref.

Descriptors: \*Farm wastes, Aeration, \*Oxidation lagoons, Waste storage, Cattle, Biological oxygen demand, \*Waste water treatment.

The oxidation ditch can be operated as a batch system for treatment of beef animal wastes in cold climates. Its role as a management system, how-ever, will be limited to that of collection, odorless temporary storage and partial treatment. Seconda ry and complete treatment of wastes will probably be accomplished by land disposal. In areas with below zero winter temperatures, a 'ditch' can be operated successfully for a 150-day batch period. After starting with a loading rate of 50 cu. ft. per animal, the solids concentration builds up to about 10-11%, which appears to be a maximum for successful operation. An estimated 20-30% REDUCTION IN SOLIDS HAS BEEN ACCOM-PLISHED. These results and the other measured parameters indicate the design criteria for use of the oxidation ditch for beef systems will be very critical and additional research is necessary. There is also a need to study the interrelation between ventilation system design and the efficient opera-tion of the ditch. Solids handling, especially with

high roughage and whole grain rations, present some unsolved problems. (See also W72-09940) (Schmitt-Iowa State)

AEROBIC TREATMENT OF LIQUID AND SOLID POULTRY MANURE, Guelph Univ. (Ontario).

J. Pos. R. G. Bell. and J. B. Robinson.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 220-224. 7 tab, 6 fig, 11 ref.

Descriptors: \*Farm wastes, \*Oxidation lagoons, Biodegradation, Nitrification, Denitrification, Aeration, Poultry, Waste storage, \*Waste water Identifiers: \*Compost.

Effects of aerobic treatment on liquid and solid poultry manure have been evaluated in a number of pilot studies. The changes in composition of liquid manure continuously aerated in 'fill and draw' oxidation ditches have been monitored over a number of 28-day storage periods over the last two years. While BOD reductions were less than had been expected on the basis of theoretical rotor efficiency, losses of nitrogen caused by nitrification-denitrification were very large and exceeded 50% of input as soon as active population of nitrifiers had become established. Solid manure aeration was evaluated in a drum fitted with an internal mixing rotor. The input consisted of equal volumes of poultry manure and soft wood shavings. The compost when discharged, after six days retention within the machine, was dark brown in color and had a strong but short-lived odor of ammonia. Although not completely stabilized, the compost could nevertheless be stored for extended periods of time without developing objectionable odors. (See also W72-09940) (Schmitt-Iowa State)

MICROBIOLOGICAL ASPECTS OF AEROBI-CALLY TREATED SWINE WASTE, School of Agriculture, Aberdeen (Scotland), Bac-

teriology Div. K. Robinson, J. R. Saxon, and S. H. Baxter

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 225-228. 7 fig, 2 tab, 6 ref.

Descriptors: \*Farm wastes. \*Aerobic treatment. Aeration, Chemical oxygen demand, Salmonella, Streptococcus, Pathogenic bacteria, \*Waste water treatment. Identifiers: \*Staphylococcus.

The aerobic microbial degradation of swine wastes was evaluated in field studies. Studies on the influence of diet on the composition of waste as a microbial substrate have shown the excretion of inhibitory levels of copper. Chemical analyses of some of the soluble components have made it possible to compare the rates of breakdown of these components with changes in pH and the rate of removal of Chemical Oxygen Demand. A progressive and marked fall in oxygen solubility occurs as the waste concentration increases. Suspensions of Salmonella, Streptococcus, or Staphylococcus were inoculated into aerating urine cultures; these organisms survive for periods exceeding 8 days. It is possible to produce a biologically stable effluent, occasionally with a satisfactory BOD, and a clean, odorless, residual solid. Further work is needed to show how the process of purification can be improved and more W72-09940) clearly understood. (See also (Schmitt-Iowa State)

CROP PRODUCTION AND SOIL ANALYSES AS AFFECTED BY APPLICATIONS OF CATTLE FEEDLOT WASTE, Southwestern Great Plains Research Center,

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Bushland, Tex.

A. C. Mathers, and B. A. Stewart.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 229-234. 2 tab, 6 fig, 3 ref.

Descriptors: \*Farm wastes, \*Grain sorghum, \*Crop response, Soil tests, Leaching, Nitrates, Cattle, Feed lots, Irrigation effects.

A field study was initiated in 1968 to determine the effect of varying rates of cattle feedlot waste on crop growth, nitrate content of forage, and accumulation of nitrate, chlorides, and other constituents in the soil profile. Rates of feedlot waste were 0, 10, 30, 60, 120, and 240 T/A applied to the same plots annually. One treatment received 240 T/A the first year only. Commercial fertilizer treatments of 240-0-0 and 240-50-50 lbs/A applied annually were also included to compare to the waste treated plots. Wastes were spread and plowed under in the spring. In 1969, the plots were not irrigated prior to seeding grain sorghum, but they were in 1970. Seasonal irrigations were applied as needed to provide adequate moisture for plant growth. Soil samples were taken before the experiment was started, at seeding times, and following harvests. Samples were analyzed for nitrate, nitrite, ammonium, chlorides, and conductivity. Yield values and soil analyses concerning the first two years of the study are presented and discussed. (See also W72-09940) (Schmitt-Iowa W72-10004

BARRIERED LANDSCAPE RENOVATION SYSTEM FOR REMOVING PHOSPHATE AND NITROGEN FROM LIQUID

Michigan State Univ., East Lansing. Dept. of Agricultural Engineering.

A. E. Erickson, J. M. Tiedje, B. G. Ellis, and C. M.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 232-234. 2 fig, 2 tab.

wastes, Denitrification, Nutrient removal, Feed lots, Hogs, \*Waste water treatment. Identifiers: \*Barriered Landscape Water Renovation System.

A Barriered Landscape Water Renovation System (BLWRS) consists of an inexpensive impervious water barrier installed below the surface of sand soils. The barrier modifies the soil environment so that an aerobic zone and an anaerobic zone are formed in the soil. The liquid waste is spread on the aerobic zone where the organic matter is decomposed and the nitrogen compounds nitrified. The nitrate is leached into the anaerobic zone where denitrification takes place. The phosphate is removed from the system by adsorption on a phosphate adsorber and in the soil. The renovated water, low in adsorption on a phosphate adsorber and in the soil. The renovated water, low in nitrogen, phosphate, and organic matter, seeps off the edges of the barrier into the aquifer or the water can be collected and recycled. Anaerobic swine waste was spread on this barrier. The total nitrogen content of the wastewater was 440 ppm and of the effluent less than 2 ppm. The average phosphate content of the waste was 38 ppm and of the effluent 0.04 ppm of phosphate. This simple, inexpensive, and efficient way of disposal of feedlot wastewater will also protect surface and underground waters from contamination. (See also W72-09940) (Schmitt-Iowa State) W72-10005

WATER QUALITY OF RUNOFF FROM GRASS-LAND APPLIED WITH LIQUID, SEMI-LIQUID, AND 'DRY' DAIRY WASTE, Auburn Univ., Ala. Dept. of Animal and Dairy

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T. A. McCaskey, G. H. Rollins, and J. A. Little. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 239-242. 1 fig, 5 tab, 4 ref.

Descriptors: \*Farm wastes, \*Return flow, Water quality, Cattle, Odor, Biochemical oxygen demand, Agricultural runoff, \*Water reuse, Waste disposal. Identifiers: \*Field-spreading.

Dairy waste was applied to runoff plots to simulate rates of application employed on Auburn Univer-sity Agr. Exp. Station: (a) irrigation of waste from a holding tank; (b) spreading by a tank wagon, and (c) conventional manure spreader for applying 'dry waste'. Irrigation of liquid manure on grassland at 0.96 toms per acre (dry basis) once each 3 weeks has been practiced with commercial equipment for 21 months. There were no significant odors, flies, or manure accumulation problems at the disposal site. The application of 0.6 tons per acre once or twice during a three-week period by a tank spreader for 19 months also did not cause any problems. The application of waste by the conventional method on permanent disposal sites at rates greater than 3.2 tons/acre once each three weeks resulted in marked accumulation of manure solids. Rates exceeding those accomplished with one or two applications per three-week cycle are not advised unless a cropping system is used. The average BOD5 was 147 mg/l for runoff from grassland applied with an accumulative total of 34 tons (dry basis) per acre as irrigated waste, 45 mg/l for 22 tons/acre of semi-liquid waste, 87 mg/l for 122 tons/acre dry waste, and 17 mg/l for the control. (See also W72-09940) (Schmitt-lowa State) W72-10007

AEROBIC STORAGE OF POULTRY MANURE, Greenmount Agricultural and Horticultural Coll., Muckamore (Northern Ireland).

T. A. Stewart, and R. McIlwain.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 261-262, 2 tab.

Descriptors: \*Farm wastes, \*Aeration, \*Aerobic conditions, Waste assimilative capacity, Poultry, \*Waste storage, \*Oxidation lagoons.

The use of an oxidation ditch, built directly underneath a 936 bird set of California cages, to aerobically store poultry droppings has been investigated for the past two years. The 2-foot long rotor is fitted with angle-iron type blades and is driven by a 1.5 H.P. electric motor at a fixed speed of 120 r.p.m. Droppings output of the birds during the first year of operation averaged 245 lb. per day, giving a total solids loading of 59 lb., of which 71% was volatile. The BOD of the fresh droppings during this period averaged 40,860 ppm., which was a daily BOD loading on the ditch of 10.3 lb. To avoid sedimentation, it was necessary to empty the ditch when the solids content of the liquid rose above 30,000 ppm. A nutrient budget at the end of the first yearly cycle showed that 43 percent of the total solids, 56 percent of the volatile solids, 60 percent of the COD and BOD and 66 percent of the nitrogen entering the ditch were lost through bacterial activity during storage. Foaming, floating feathers, and mechanical failure of rotor bearings were the main problems encountered. Electricity consumption averaged 1 kilowatt per hour. (See also W72-09940) (Schmitt-Iowa State) W72-10013

SURVIVAL AND DETECTION OF LEP-TOSPIRES IN AERATED BEEF CATTLE MANURE, Minnesota Univ., St. Paul. Dept. of Agricultural

Engineering.
For primary bibliographic entry see Field 05A. W72-10014

AERATION WITH ORP CONTROL TO SUP-PRESS ODORS EMITTED FROM LIQUID SWINE MANURE SYSTEMS, Illinois Univ., Urbana. Dept. of Agricultural En-

gineering.
J. C. Converse, D. L. Day, J. T. Pfeffer, and B. A.

Jones.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 267-271, 4 fig, 6 tab, 10 ref.

Descriptors: \*Farm wastes, \*Aeration, \*Odor, Biodegradation, Hogs, Hydrogen sulfide, Organic acids, \*Waste water treatment, Oxidation-reduction potential.

Five levels of aeration of a completely mixed liquid swine manure system were studied to determine the effect on odors produced and to study the degradation of manure under each system. Oxidadegradation of manure under each system. Oxidation-Reduction Potential (ORP), pH, temperature, and dissolved oxygen levels of the mixed liquor were recorded daily. Analyses of the mixed liquor and off-gas were performed. The average ORP (E-cal) values for chambers 1 through 5 were +143, -212, -344, -425, -482 mv, respectively. An average D.O. of 4.68 mg/l was maintained in chamber 1 while measurable D.O. was only occasionally found in chamber 2, and never found in the remaining chambers. The total volatile acids concentration in chambers 2 and 3 was about 30 and 10 centration in chambers 2 and 3 was about 30 and 10 times less, respectively, than in chambers 4 and 5. The average total sulfides concentration in the mixed liquor of chambers 2 and 3 was about 22 and mixed liquor of chambers 2 and 3 was about 22 and 3 times less, respectively, than in chamber 5. No hydrogen sulfide was found in the off-gases of chambers 1 and 2. Chambers 3, 4, and 5 had an average of 0.59, 5.78 and 21.57 mg/day as S washed from the off-gases. If the ORP in the liquid is maintained in a range from -300 my to -340 my and the pH is in the range from 7.7 to 8.5 the system will be relatively odorless when compared to systems undergoing anaerobic degradation. (See also W72-10015

NITROGEN TRANSFORMATION DURING AEROBIC DIGESTION AND DENITRIFICA-TION OF DAIRY CATTLE WASTES, Purdue Univ., Lafayette, Ind. Dept. of Agricul-

tural Engineering.
A. C. Chang, A. C. Dale, and J. M. Bell.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 272-274, 1 tab, 7 fig, 6 ref.

Descriptors: \*Farm wastes, \*Nitrification, \*Denitrification, Aeration, Aerobic conditions, Cattle, Nitrogen cycle, \*Waste water treatment.

Besides biodegradable material, livestock wastes also contain large amounts of plant nutrients, which cause pollution problems if they are released to the environment without control. This study investigates the fate of nitrogen during anaerobic digestion of dairy cattle wastes and seeks a possible way of removing nitrogen before final disposal. The reduction of total nitrogen was found mainly due to the volatilization of ammonia during the aerobic digestion. Temperature has a significant effect on the stability of the digested wastes. For complete denitrification of the digested dairy cattle wastes, acclimated sludge and a sufficient supply of organic carbon are needed.

The amount of glucose required for complete denitrification is 150 per cent of the amount theoretically calculated. This results in a 90 per cent reduction of total nitrogen. The amount of manure slurry needed for complete denitrification of digested dairy cattle manure is an equivalent of 149 mg COD per mg of oxidized nitrogen. With a sufficient supply of organic carbon, the average rate of denitrification is 13.26 mg of nitrogen per hour. (See also W72-09940) (Schmitt-Iowa State) W72-10016

AEROBIC BIOLOGICAL BREAKDOWN OF FARM WASTE, Rijkszuivel Agrarische Afvalwater Dienst, Arnhem (Netherlands). P. Ten Have.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 275-278, 1 fig. 7 tab, 1 ref.

Descriptors: \*Farm wastes, \*Denitrification, \*Aeration, \*Activated sludge, Aerobic conditions, Cattle, Hogs, Costs, Waste water treatment, Slur-

One of the ways to reduce dung surpluses is the exposure to aerobic biological breakdown. The aim of this treatment is not only the reduction of the suspended solids in the manure, but also of the volume by producing effluents which are discharged to watercourses. When using the activated sludge process with a load of 200-300 g BOD per cubic meter per day, the effluent BOD is normally 50-100 ppm. The activated sludge settles very well (Sludge, volume index mostly below 50), so sludge levels greater than 10 Kg MLSS per cubic meter can be maintained. The result is a low sludge load of less than 30 g BOD per Kg MLSS per day. When pig slurry is treated, about 40 percent of the original solids has to be removed as surplus sludge. With urine only, breakdown reaches 75 percent. The surplus sludge must be disposed but has a smaller volume, better dewaterability, and lack of obnoxious odors. A large part of the nitrogen is lost by denitrification, with waterability, and lack of ohnoxious odors. A large part of the nitrogen is lost by denitrification, with 30 percent discharged with the effluent. Biological degradation is only economically justified in The Netherlands when agricultural use is impossible within a range of more than about 10 kilometers. (See also W72-09940) (Schmitt-Iowa State) W72-10017

LOW-VOLUME, SURFACE-LAYER, AERA-TION--CONDITIONED MANURE STORAGE, Clemson Univ., S.C. Dept. of Agricultural En-C. L. Barth, and L. B. Polkowski.

Descriptors: \*Farm wastes, \*Aeration, \*Odor, \*Waste storage, Cattle, Farm lagoons, Aerobic conditions, Waste water treatment, Slurries. Identifiers: \*Surface-layer aeration.

Storage periods for wastes up to six months are necessary to maintain the quality of water resources and to complement schemes for intensified livestock production. A preliminary investigation of the procedure of low volume, surface layer aeration of stored, diluted dairy manure was made. Air was introduced into the supernatant was made. Air was introduced into the supernatant of stored manure at various rates and depths. The supernatant of properly aerated storage units was characterized by higher oxidation-reduction potential, dissolved oxygen, and pH than poorly aerated and anaerobic storage. It also had lower volatile organic acid, ammonia, BOD, suspended solids and odor intensity. The sludge of the well-aerated unit was characterized by higher solids concentration and a distinct surface senarating the concentration and a distinct surface separating the concentration and a distinct surface separating the sludge and supernatant zones. Low volume, surface layer aeration effectively reduced odor production, produced a scum-free surface and a more concentrated sludge layer. Favorable storage conditions were associated with ORP greater than -50 mv (Ec), D.O. greater than 1.0 mg/l and pH greater than 8.0. An aerated depth of 20 to 24 inches was desirable. After sixty days storage, about 85% of total volume, 85% of the COD and

### **Group 5D—Waste Treatment Processes**

79% of the nitrogen was recovered. (See also W72-09940) (Schmittelowa State) W72-10018

SHORT TERM AERATION OF DAIRY CATTLE

MANURE FOR IRRIGATION, Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
J. R. Ogilvie, and A. C. Dale.
In: Livestock Waste Management and Pollution

Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 283-285, 4 fig, 12 ref.

Descriptors: \*Farm wastes, \*Aeration, \*Odor, Sprinkler irrigation, Waste storage, Cattle, Chemical oxygen demand, \*Waste water treatment.

Short-term aeration reduces odors from dairy cattle wastes. This was demonstrated by use of a 2 H.P. floating aerator in a 15 foot diameter, 42 inch deep tank into which raw concrete vard manure was loaded in batch made to a maximum mixed liquor total solids content of 1.75 percent and a COD of 17,600 mg/l. Daily irrigation removed the excess liquid. The mixed liquor was odor free at all times, in the tank and on grassland. There is a conversion of soluble organics to cell material, as about 80% of the soluble COD is removed. The process requires very good mixing to prevent particles of roughage from settling. The mixing may be performed by a turbine in a baffled vessel or by a Kessener brush in a rectangular tank. Dilution of the raw manure is necessary to allow treatment but the extra two volumes of water are usually available from rainfall, washwater, or special addition. The volume of treatment facility is much reduced from the oxidation ditch. The input oxygen is the same or somewhat reduced. In cold climates, this process could be used with an additional aerated lagoon to take the winter effluent. (See also W72-0) (Schmitt-Iowa State) W72-10019

THE USE OF OXIDATION PONDS FOR POULTRY PROCESSING WASTE DISPOSAL Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering. R. L. Wesley, E. B. Hale, and H. C. Porter. In: Livestock Waste Management and Pollution

Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 286-287.

Descriptors: \*Farm wastes, \*Poultry, \*Industrial wastes, Oxidation lagoons, Odor, Virginia, \*Food processing industry.

Poultry processing waste is a suitable substrate for biological degradation by both aerobic and anaerobic bacteria. Several poultry processors in Virginia have faced varying stages of court litigation involving waste disposal. A team of specialists, including a biologist, an agricultural engineer, agronomist, a sanitary engineer, a poultry processing specialist and a member of the State Water Control Board Staff were appointed by the Dean of Cooperative Extension Service at VPI to assist a processor with his problems. This group gathered the basic facts concerning the problems as follows: (a) total hydraulic load; (b) BOD 5; (c) total solids; (d) total dissolved solids; (e) D.O., and (f) fecal coliforms. These determinations were made on raw effluent, treated effluent, and on the receiving stream. A treatment system composed of a grease and grit trap, a series of lagoons and natural aeration was developed. These lagoons cover 8 acres, have a capacity of 12 million gallons, and provide a detention time of 81 days. Reductions are as follows: (a) 97% BOD removal: (b) 87% solids removal, and (c) fecal coliforms are less than 100/100 ml in the receiving stream. This treatment cost approximately \$30,000. (See also W72-09940) (Schmitt-Iowa State) W72-10020

ACCLIMATIZATION RESPONSE TIME FOR AEROBIC WASTE DIGESTORS, Georgia Univ., Athens. Dept. of Agr gineering. D. T. Hill, and R. E. Smith.

In: Livestock Waste Management and Pollution

Abatement, Proceedings International Symposium on Livertock Wastes, Ohio State University, April 19-22, 1971, p 288-290, 5 fig, 2 tab, 5 ref.

Descriptors: \*Farm wastes, \*Activated sludge, Anaerobic digestion, Time lag, Biochemical ox-ygen demand, \*Waste water treatment. Identifiers: \*Acclimatization time, Time constant.

Extant circumstances for many anaerobic swine waste lagoons in present use often ensure aperiodic effluents. The output from operating aerobic lagoons is unacceptable for receiving streams. This research was conducted to establish design criteria for an aerobic activated -sludge reactor for use with the aperiodic effluents from anaerobic lagoons. Objectives were to determine a general prediction equation for the transient time as a function of the off time of an aperiodically operating treatment unit and to determine the effect of a low-maintenance aeration supply on the transient operation time of the aerobic process. The use of maintenance aeration was found to have no significant effect on the value of the acclimatization time. Since there was no solids removal during the study, acclimatization time was defined as the time necessary to achieve 63.6% BOD reduction in the liquid ph and is referred to as a time constant. The acclimatization time ranged from 5.69 to 15.21 hours between zero and infinity for values of down time. (See also W72-09940) (Schmitt-Iowa State)

CATTLE MANURE AS FEED FOR CATTLE, Alabama Agricultural Experiment Station, Auburn. Dept. of Animal and Dairy Sciences. ary bibliographic entry see Field 05G. W72-10023

NUTRITIVE EVALUATIONS OF UNTREATED AND CHEMICALLY TREATED DAIRY CAT-

TLE WASTES, Agricultural Research Service, Beltsville, Md.

Animal Science Research Div.
L. W. Smith, H. K. Goering, and C. H. Gordon.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 314-318, 8 tab, 5 ref.

Descriptors: \*Farm wastes, \*Recycling, Drying, Cattle, Sheep, Nutrients, Chemical degradation, Lignins, Cellulose, Wood wastes, \*Waste water

Studies were conducted to determine the extent to which digestibility of manure plus urine and hard-wood sawdust (barn waste, BW) or manure alone was increased by chemical treatments when reused as feed for sheep. Dairy cattle wastes were collected from a gutter cleaner. BW were (1) untreated or treated by adding and mixing either, (2) 3% sodium hydroxide, (3) 3% sodium peroxide, or (4) 3% sodium chlorite with the wet wastes. All were stored in plastic-sheet covered piles for 4 weeks before drying with forced hot air. The four materials were ground through a 3/8 inch hammer-mill screen and mixed as 83% BW, 10% cornmeal, and 7% soybean meal. These were pelleted and fed ad lib in a completely randomized experiment for 30 days. During the last 7 days, consumptions and digestibilities were measured. Dry matter digesti-bilities were: untreated, 23.05; sodium hydroxide, 27.32; sodium peroxide, 34.63; and sodium chlorite, 35.28. Cell wall digestibilities were: 9.67, 10.50, 17.11, and 21.92, respectively. Digestibilities of chemical treated feces were not increased to the extent observed in nitro. The less than predicted fiber digestibility may be the result of rapid passage of fecal fiber through the rumen or less

than optimum treatment conditions. (See also W72-09940) (Schmitt-Iowa State) W72-10029

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TREATMENT OF LIVESTOCK-LAGOON EF-FLUENT BY SOIL FILTRATION, Iowa State Univ., Ames. Dept. of Agricultural En-

gineering. J. K. Koelliker, J. R. Miner, C. E. Beer, and T. E.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 329-333, 2 tab, 6 fig, 5 ref.

Descriptors: \*Farm wastes, \*Nutrient removal, Fertilization, Sprinkler irrigation, Farm lagoons, Leaching, Phosphorus, Nitrate, \*Waste water treatment, Filtration, Iowa.
Identifiers: Soil filtration, Anaerobic lagoon ef-

In Iowa, anaerobic manure lagoon effluent can be successfully treated and disposed of between mid-April and early November by sprinkler irrigation. To minimize the possibility of runoff, the applica-tion rate should be less than half the suggested infiltration rate for clear water on the same soil. On poorly drained soils, a total application of 2 inches was the amount that could be applied at 0.40 inches per hour without runoff. Soil filtration removed from 79-93 percent of the COD, 90-97 percent of the total P, and 48-67 percent of the total-N when 14.8 to 31.4 inches of lagoon effluent were applied in one season to field plots. The total-N is the constituent that likely will limit the amount of liquid that should be applied in a season because of high nitrate-N (130-190 mg/l N) found in the tile drainage with intense applications. 600 pounds per acre of N per season is recommended. Fescue, brome, and ryegrass have grown satisfactorily where lagoon effluent was applied as long as the soil did not remain flooded. Over a three year period, measures of the chloride ion, an indic of total salt content, show approaching equilibri-um, the concentration in the tile drainage about equal to that of the lagoon effluent. (See also W72-09940) (Schmitt-Iowa State) 72-10033

GROWTH RESPONSE OF PLANTS UNDER SPRINKLER IRRIGATION WITH DAIRY

Florida Univ., Gainesville, Dept. of Agricultural Engineering.

A. R. Overman, C. C. Hortenstine, and J. M. Wing.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 334-337, 6 tab, 9 fig, 8 ref.

Descriptors: \*Farm wastes, Sprinkler irrigation, Crop response, Fertilizers, Cattle, Nutrient removal, Leaching, Slurries. Identifiers: Dairy wastes.

The soil-plant system was used as a sink for the nutrients in dairy waste. Manure slurry of about 0.2 percent solids was applied to plants by sprinkler irrigation at various rates to determine grow response curves. For oats the rates were 1/4, 1/2 1 inch per week, while sorghum received 0, 1 and 1 inch per week, white sorgnum received 0,7 and 2 inches per week. Ground water samples were collected periodically and analyzed for nitrates and phosphates. Growth response of both crops is described quite well by the Mitscherlich equation, which emphasizes relative yield. Relative yields of oats were 40, 65, and 88 percent of optimum for application rates of 1/4, 1/2 and 1 inch per week respectively. Maximum yield (green weight) for oats was estimated to be 12.25 tons per hectare (5 tons/acre), while the value for sorghumsudangrass was 90.7 tons per hectare (36.8 tons/acre). Oats grown with dairy manure measure up to those grown with inorganic fertilizer in chemical composition, palatability, and digestibili-ty. (See also W72-09940) (Schmitt-Iowa State) W72-10034 NITROGEN REMOVAL FROM SEWAGE WATERS BY PLANTS AND SOIL, Maryland Univ., College Park. Dept. of Agrono-

For primary bibliographic entry see Field 05G.

RENOVATION AND REUSE OF WATER FOR DILUTION AND HYDRAULIC TRANSPORT OF DAIRY CATTLE MANURE,

MASSACHUSETS UNIV. Amherst. Dept. of Food and Agricultural Engineering. R. E. Graves, J. T. Clayton, and R. G. Light. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, 341-344, 5 fig, 3 tab, 8 ref.

Descriptors: \*Farm wastes, \*Slurries, \*Screens, Cattle, Aeration, Recycling, Coliforms, \*Water reuse, Waste treatment. Identifiers: Bar screening.

f-

Slurries of dairy cattle manure contain many solids which form scum mats and sludges in holding tanks and cause other problems during treatment. A stationary sloping screen with a 0.02 inch bar spacing used as a pretreatment step removed over 50% of the total solids present in manure slurries ranging from 50:1 to 2:1 (water to wet manure by weight). Two aerated treatment systems were stu-died, one using settled screen effluent and the other the entire screen effluent. Each system was duplicated with one using recycled effluent in the loading slurry and the other using fresh water. No e affects on treatment operations were at tributed to recirculation. There was little dif-ference in the effluents between systems. Concentration of salts and minerals increased in the recirculated systems which might cause problems eventually. Population of two indicator organisms did not increase in the recycled systems. Clogging and damage to pumps and nozzles in irrigating systems is reduced for the screened liquid. Storage for intermittent application requires less volume, and scum mats are eliminated from ponds by screening. (See also W72-09940) (Schmitt-Iowa State) W72-10036

THE SEPARATION OF SOLID AND LIQUID

PARTS OF PIG SLURRY, Instituut voor Landbouwbedrijfsgebouwen, Wageningen (Netherlands).

For primary bibliographic entry see Field 05G. W72-10037

DEWATERING POULTRY MANURE BY CEN-TRIFUGATION, Kentucky Univ., Lexington. Dept. of Agricultural

Engineering.
I. J. Ross, J. J. Begin, and T. M. Midden.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 348-350. 2 fig, 1 tab, 4 ref.

Descriptors: \*Farm wastes, \*Poultry, \*Dewatering, Centrifugation, Waste water treatment, Moisture content, Time, Temperature. Identifiers: Imperforate basket type centrifuge, Manure washing.

Poultry manure is excreted at a moisture content of approximately 75 percent (wet basis) and can be dewatered by centrifugation. Tests have been conducted to determine the amount of fluid that can be removed from fresh manure in an imperforate be removed from fresh manure in an imperforate basket type centrifuge. The variables investigated include (1) time of centrifugation - 1 to 12 minutes, (2) centrifugal force - 2000 to 10,000 g, (3) initial moisture content - 75% to 95% and (4) temperature -40 to 120 degrees F. As much as 40% of the water can be removed from the manure at 75% moisture content and as much as 70% can be removed at 95% moisture content. Time of centrifugation in a bowl centrifuge for 1 to 12 minutes has little effect

on the percentage of water removed except at low relative centrifugal forces (RCF) and high solids concentrations. Increasing the RCF significantly affects the percentage of water removed only at high solids concentrations. Increasing the temperature in the range of 40 to 160 degrees F increases the percentage of water that can be removed by centrifugation. (See also W72-09940) (Schmitt-Iowa State) W72-10038

CONCENTRATION OF PROTEINACEOUS SOLIDS FROM OXIDATION DITCH MIXED-

Illinois Univ., Urbana. Dept. of Agricultural En-

gineering.
L. W. Holmes, D. L. Day, and J. T. Pfeffer.
In: Livestock Waste Management and Pollution
Abatement, Proceedings International Symposium
on Livestock Wastes, Ohio State University, April
19-22, 1971, p 351-354, 8 fig, 4 ref.

Descriptors: \*Farm wastes, \*Recycling, Aeration, \*Centrifugation, Hogs, Nutrients, Proteins, Water reuse, Waste water treatment.

Biodegradation of swine waste in an under-thefloor oxidation ditch produces a mixed-liquor that contains minute, protein-rich particles. The 82.6 percent (dwb) portion of a swine ODML sample that passed through a 200 - mesh screen contained 75.6 percent (dwb) crude protein. Centrifuged samples of swine ODML contained a greater percentage (dwb) of crude protein and essential amino acids than corn. Centrifugation is one possible method of suspended solids concentration. The solid bowl basket-type centrifuge used in pilot plant trials was capable of concentrating the proteinaceous solids in swine ODML from an initial value of 1.2% S.S. to a desired concentration of 6 to 8 percent S.S. This represents a volume reduction of 85 percent. This removes a substantial amount of liquid that contains no measureable amino acids. COD reduction closely followed S.S. recovery values. Investigations into potential health hazards to man and animal arising from infection by pathogenic organisms in the manure will need to be conducted before this method of manure recycling may be advocated for common use. (See also W72-09940) (Schmitt-Iowa State)

CONVENTIONAL USE OR REUSE-A COST COMPARISON, Louis Koenig-Research, San Antonio, Tex.

For primary bibliographic entry see Field 06B. W72-10108

DISCUSSION OF DISPOSAL OF SLUDGE AT WATER PURIFICATION AND SOFTENING WORKS OF THE MAHONING VALLEY SANI-TARY DISTRICTS.

Ohio Dept. of Health, Columbus. For primary bibliographic entry see Field 05F. W72-10131

DISPOSAL OF SLUDGE AT WATER PURIFICA-TION AND SOFTENING WORKS OF THE MAHONING VALLEY SANITARY DISTRICT, Mahoning Valley Sanitary District, Youngstown,

For primary bibliographic entry see Field 05F. W72-10132

A STUDY OF SLUDGE AT WATER PURIFICA-A STUDY OF SLUDGE AT WATER PURIFITION PLANTS IN NEW ENGLAND, Cambridge Water Dept., Mass. For primary bibliographic entry see Field 05F. W72-10135

RECOVERY OF WATERWORKS SLUDGE, For primary bibliographic entry see Field 05F. W72-10136 RECOVERY OF WATERWORKS SLUDGE - II, For primary bibliographic entry see Field 05F. W72-10137

PROBLEMS IN DISPOSAL OF SLUDGE AND WASHWATER FOR CONNECTICUT WATER FILTRATION PLANTS, Connecticut Dept. of Health, Hartford. For primary bibliographic entry see Field 05F.

THE PITSFORD TREATMENT WORKS OF THE MID-NORTHAMPTONSHIRE WATER BOARD

Mid-Northamptonshire Water Board (England). For primary bibliographic entry see Field 05F. W72-10139

TOKYO'S ASAKA PURIFICATION PLANT, Tone River Waterworks Construction Center, Tokyo (Japan). For primary bibliographic entry see Field 05F. W72-10141

LIME RECOVERY FROM WATER SOFTENING

SLUDGES, Minneapolis Water Dept., Minn. For primary bibliographic entry see Field 05F. W72-10142

USE OF THE TBOD TEST WITH COLLOIDAL WASTE-WATERS, California Univ., Davis. Dept. of Civil Engineer-

M. K. Mullis, and E. D. Schroeder. Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, p 605-611. 6 fig, 9 ref.

Descriptors: \*Activated sludge, \*Control, \*Moni-toring, Analytical techniques, Chemical oxygen demand, Biochemical oxygen demand, Laborato-ry tests, Growth rate, Oxidation, Metabolism, Protozoa, Bacteria, Waste water treatment. Identifiers: \*TbOD, \*Process control.

Criteria for a good test for controlling the operation of an activated sludge plant include: (1) a theoretical base; (2) excellent reproducibility; (3) short duration time; (4) simplicity and economy of technique utilizing equipment commonly available in most laboratories; and (5) reasonable precision. The TbOD test which has been recently developed has been suggested for testing since it more nearly complies to these criteria than do either conventional COD and BOD tests, or instrumented COD tests. Results indicated that a reliable correlation between TbOD and COD could be obtained for wastes of fairly consistent strength. Constant filtrate COD values can be used as an end point in-dicator for the TbOD tests, and these tests were shown to be valid for such non-soluble wastes as sewage. Although time required to obtain data is as much as 8 hours, in most plants receiving fairly uniform flow, the TbOD test can provide excellent control information. Since the correlation has no theoretical meaning, continued checks on the relationship are recommended. (Lowry-Texas) W72-10209

BLAST FURNACE GAS WASHER REMOVES CYANIDES, AMMONIA, IRON AND PHENOL, Interlake Steel Corp., Riverdale, Ill. R. A. Decaigny, and F. G. Krikau. Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, p 512-517. 3 tab.

\*Industrial wastes. Descriptors: \*Suspended solids, \*Water reuse, Phenol, Coagulation, Polyelectrolytes, Chemical precipitation, Hydrogen ion concentration, Alkalinity, Scaling, Vacuum drying, Design criteria, Waste water treatment.

### **Group 5D—Waste Treatment Processes**

Cleaning of blast furnace gas with water results in a water with increased pH, temperature, alkalini-ty, and suspended solids, cyanides, ammonia, and iron content. Recent laws requiring an ever cleaner discharge have stimulated much interest in water reuse since once it is clean enough to be discharged it is also clean enough to reuse. recycling system was installed both on the blast furnace and the sinter plant of the Interlake Steel Corporation. These systems consisted of polyelectrolyte addition, sedimentation, and sludge concentration, as well as cooling towers. The recycle systems were phased into operation at both plants with no downtime. However, once in operation, water infiltration from unknown sources made it impossible to eliminate blowdown to the river. Other problems included high suspended solids concentrations at the sinter plant, and lack of pH control for the sinter plant system. These and other problems were regarded as normal 'debugging' difficulties which would be encountered in the start-up of any new plant. However, as of March 1970, the system has been in balance all discharges have been eliminated. (Lowry-Tex-W72-10210

BIOLOGICAL DEGRADATION OF TUNA

Public Health Service, Honolulu, Hawaii. B. F. Pearson, M. J. Chun, R. H. F. Young, and N.

Proceedings, Industrial Waste Conference, 25th, May 7-9, 1970, p 766-772. 6 fig, 1 tab, 5 ref.

Descriptors: \*Industrial wastes, \*Waste water treatment, \*Activated sludge, Laboratory tests, Biodegradation, Oxygen requirements, Chorides, Nutrient requirements, Biochemical oxygen demand, Hydrogen ion concentration, Food processing industry, Fish.

Identifiers: Tuna packing, Warburg respirometer, Mixed-liquor suspended solids, Shock loading, Oxygen uptake, Synthetic waste.

The biodegradability of tuna waste was studied utilizing activated sludge in the Warburg Respirometer; a bench model of a batch fed aeration unit and a continuous flow aeration unit. A synthetic tuna waste was prepared in the laboratory to provide continuity of waste characteristics. The parameters used in the biodegradability study were the COD, BOD5, total solids, total volatile solids, organic nitrogen, pH, chlorides, grease, phosphates and the mixed-liquor-suspended solids (MLSS) of the activated sludge. Results showed about a 60 percent reduction in BOD and suspended solids could be obtained. Variation in MLSS indicated that a MLSS of 3,500 mg/l was optimum for BOD reduction. Oxygen transfer efficiency was a limitation with greater solids concentrations. Tuna packing waste was shown to be a highly proteinaceous waste. However, the ac-tivated sludge units had to be buffered with both phosphates and readily available nitrogen for without these, adverse pH levels were reached rapidly. Studies with variable chloride content indicated that chloride values of up to 9,000 mg/l did not affect oxygen uptake. However, with greater chloride concentrations total oxygen uptake and BOD reductions were inhibited. Complete failure occurred when the units were shock loaded. (Galwardi-Texas) W72-10212

ANAEROBIC DIGESTION OF PINEAPPLE MILL WASTES.

Hawaii Univ., Honolulu. School of Public Health. M. J. K. McMorrow, N. C. Burbank, Jr., R. H. F. Young, L. S. Lau, and H. W. Klemmer. Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, p 575-585. 6 fig, 3 tab, 21 ref.

Descriptors: \*Food processing industry, \*Industrial wastes, \*Fruit crops, \*Anaerobic digestion, Laboratory tests, Sampling, Hydrogen ion concentration, Alkalinity, Temperature, Mixing,

Nutrients, Phosphorus, Chemical oxygen demand, Methane, Carbon dioxide, Waste water treatment. Identifiers: \*Pineapple wastes, \*Sugars.

Synthetic pineapple wastes, consisting mainly of low pH wastes containing large amounts of sugars were digested anaerobically in laboratory scale digesters. Synthetic wastes were used in order to control the number of variable conditions during digestion. Results indicated that pineapple wastes are unsuitable for treatment by anaerobic digestion under uncontrolled conditions, since digesters operated at ambient temperature produced only a 40% COD reduction. Addition of 75 mg/l phosphorus resulted in 51% COD reduction, mixing of the unheated digester produced a 53% COD reduction, and digesters operated at 90F affected a 66% COD reduction while regularly producing a gas containing 75% or more CH4. The heated digesters also had the highest alkalinity levels, giving them more natural buffering capacity. (Lowry-Texas)

PULP MILL LIGNIN IN CONTINUOUS PETROLEUM FERMENTATION,

Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters.

D. L. Liu, and P. M. Townsley.
Journal Water Pollution Control Federation, Vol
44, No 2, Feb 1972, p 232-240. 11 fig, 6 ref.

Descriptors: \*Oil wastes, \*Fermentation, \*Lignins, Emulsions, Metabolism, Bacteria, Organic compounds, Laboratory tests, Paper pulp wastes, Chemical precipitation, Flocculation, Waste water treatment. Identifiers: \*Kerosine.

Continuous hydrocarbon fermentation for over 200 hours using pulp mill thiolignins or lignosulphonates and a modified cyclone fermenter has been accomplished on a laboratory scale. This investigation demonstrated that the addition of various culture medium ingredients can be optimized to produce maximum cell yield or maximum acid production. Plots of organism growth rate and acid production versus kerosine concentration have shown that the addition of the thiolignin, Indulin C, causes the kerosine to become more available to the organisms. Indulin C addition to the culture medium creates a stable emulsion that overcomes the problem of the removal of a two phase system from the fermenter. Since the thiolignins can be removed by precipitation or flocculation on standing in culture fluids of high acidity, the use of lignin to improve the rate of hydrocarbon utilization in petroleum waste treatment plants or synthetic processes is suggested. (Lowry-Texas) W72-10214

SPENT SULFITE LIQUOR XIII. THE VANILLIN METHOD FOR ESTIMATION OF THE CONCENTRATION OF SPENT SULFITE LIQUOR IN WATERS

WATERS, Washington Univ., Seattle. B. F. Hrutfiord, P. Y. Jone, and J. L. McCarthy. Tappi, Vol 53, No 9, September 1970, p 1746-1749. 2 fig, 2 tab, 19 ref.

Descriptors: \*Pulp and paper industry, \*Sulfite liquors, \*Analytical techniques, Laboratory tests, Hydrolysis, Separation techniques, Gas chromatography, Instrumentation, Calibrations, Lignins, Sulfates, Organic wastes, Chemical reactions, Water quality control.

Identifiers: \*Vanillin, \*Chloroform.

The concentration of spent sulfite liquor can now be determined down to a few parts of spent sulfite liquor (containing 10% solids) per million parts of water sample. This analytical technique, the 'vanillin' method, involves: (1) extraction with chloroform to remove interfering materials; (2) alkaline hydrolysis; (3) cooling and acidification; (4)

dichloromethane extraction of the vanillin formed; (5) treatment with a silylation reagent; and (6) quantitative determination of vanillin content by gas chromatography using eugenol as an internal standard. Spent sulfite liquor content can be related to vanillin content by means of a previously constructed calibration curve. Because vanillin is formed almost exclusively by alkaline hydrolysis from the lignin sulfonates present in sulfite spent liquor, the method should be especially useful in special cases where it is important to confirm the presence (or absence) and concentration of spent sulfite liquor. For routine estimation of spent sulfite liquor concentration, however, the Pearl-Benson nitroso method is more appropriate. (Low-ry-Texas)

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CONVERSION OF CRUDE ACETATES INTO GLACIAL ACETIC ACID AND PULPING CHEMICALS,

Weyerhaeuser Co., Longview, Wash. Development Div.

C. J. Lang, and G. G. DeHaas. Tappi, Vol 53, No 6, June 1970, p 1094-1097. 5 fig, 3 tab.

Descriptors: \*Pulp and paper industry, \*Sulfite liquors, \*Chemical reactions, Acids, Sodium compounds, Pilot plants, Laboratory tests, Industrial wastes, Paper pulp wastes, Soft wood, Hard wood, Temperature, Waste water treatment. Identifiers: \*Acetic acid, \*Sodium sulfite.

Laboratory and pilot plant investigations have established the technical feasibility of recovering sodium acetate from spent sulfite liquor and converting it into glacial acetic acid, while at the same time recovering sodium sulfite for use as a makeup chemical for kraft pulping. The process consists of using a spray dryer to remove water from the 25% sodium acetate-sodium sulfite solution obtained after steam stripping of the liquor, and passing sul-fur dioxide and water vapor through the dried solids to form acetic acid and sodium sulfite. Formation of sodium sulfate and elemental sulfur is kept to a minimum. After stripping of excess suldioxide and rectification, a product containing 99.7% acetic acid and meeting all ACS specifica-tions was attained on a production basis. However, in comparison to the output of glacial acetic acid plants, the output of acid from one mill or even a complex of mills will be rather small. Therefore, it is necessary to find a use at the plant site for the end products. (Lowry-Texas) W72-10217

RECENT ADVANCES IN AIR FLOTATION TECHNOLOGY,

The Sybron Corp., Paramus, N.J. Permutit Co., Div.

H. Lundgren. Tappi, Vol 53, No 2, February 1970, p 287-289. 2 fig. 1 tab.

Descriptors: \*Pulp and paper industry, \*Suspended solids, \*Flotation, Wood wastes, Coagulation, Flocculation, Turbulence, Laminar flow, Baffles, Regulation, Pilot plants, Design criteria, Sludge, Waste water treatment. Identifiers: \*Lamella, \*Hydraulic loading.

The air flotation process is well established as an economical suspended solids removal process. However, introduction of lamellas into the flotation vat has produced a major advance in flotation technology. Lamellas are thin flat plates forming a series of baffles which confine and direct the flow, preventing the occurrence of hydraulic conditions which are unfavorable to the process. Since turbulence and unfavorable hydraulic flow patterns are effectively prevented, the flotation process can be operated at higher loading rates, permitting considerable unit size reduction. Size reduction makes possible: (1) reduction of required floor space by 40 to 50% of that required for conventional flotation; (2) reduction of floor loading; (3) reduction of

erection costs; and (4) prefabrication of smaller units. In addition, since this system is less sensi-tive to waste variables, the application of flotation for intermediate or final mill effluent clarification nes more attractive. (Lowry-Texas)

ALDRIN: REMOVAL FROM LAKE WATER BY FLOCCULENT BACTERIA, Ohio State Univ., Columbus, W. O. Leshniowsky, P. R. Dugan, R. M. Pfister, J. I. Frea, and C. I. Randles.

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Science, Vol 169, September 4, 1970, p 993-994. 2

Descriptors: \*Aldrin, \*Adsorption, \*Flocculation, \*Bacteria, Sedimentation, Chlorinated hydrocarbon pesticides, Aerobic conditions, Anaerobic conditions, Insecticides, Insects, Laboratory tests, Separation techniques, Centrifugation, Silts, Laber Fig. Water quality control. Lake Erie, Water quality control.

Test organisms were grown in a shake flask at 22 plus or minus 2C in nutrient broth, harvested by centrifugation, washed twice with distilled water, and resuspended in distilled water. These organisms were then exposed to final aldrin concentrations of 1 ppm, shaken at 120 rev/min for the desired time period, reharvested, extracted with a heptane acetone mixture, and both supernatant and floc were analyzed for aldrin content. Results demonstrated that floe-forming microorganisms do act as adsorbants for other suspended microparticles, including chlorinated hydrocarbons, and that this represents a natural process of removal of microparticles from the water column. Although the settled pesticides may biodegrade anaerobically, it is likely that their concentration in the bottom, even for short periods of time, would exert a bactericidal effect on the bottom insects and other susceptible fauna. Previous work has established that certain insect species have varying susceptibilities to the same pesticides, possibly an explanation for the disappearance of some insects and the increase of others in and around Lake Erie. (Lowry-Texas) W72-10220

GENERALIZED EQUATIONS FOR CRITICAL

CAYGEN DEFICIT, Camp, Dresser and McKee, Boston, Mass. For primary bibliographic entry see Field 05A. W72-10221

FITTING FIRST AND SECOND ORDER BOD REACTION EQUATIONS TO STREAM DATA, Illinois State Water Survey, Peoria. Water Quality

For primary bibliographic entry see Field 05A. W72-10222

COMPLETE MIX ACTIVATED SLUDGE TREATMENT OF CITRUS PROCESS WASTES. Winter Garden Citrus Products Cooperative, Fla.

Copy available from GPO Sup Doc, \$1.25; microfiche from NTIS as PB-210 407, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, August 1971. 120 p, 18 fig, 16 tab, 29 ref. EPA Program 12060 EZY 07/71.

Descriptors: \*Food processing industry, \*Citrus fruits, \*Activated sludge, Organic loading, Aeration, Kinetics, Lime, Chemical precipitation, Coagulation, Temperature, Nutrient requirements, Nitrogen, Phosphorus, Centrifugation, Sludge digestion, Hydrogen ion concentration, Operation and maintenance, Foaming, Water reuse, Cost analysis, Waste water treatment, Industrial waste.

A full-scale, complete mixed activated sludge treatment system effectively treats concentrated wastewater from the Winter Garden Citrus Products Cooperative. This process has a BOD reduction capability of 99 percent; but it produces 0.5 to 0.6 pounds of waste sludge per pound of in-fluent BOD. The efficiency was reduced by periodic foaming and solids carryover in the ef-fluent caused by the unscheduled discharge of orange oil and peel press liquor to the treatment plant. Controlling the addition of nitrogen and phosphorus to the influent of the nutrient deficient wastewater effectively controlled effluent nitrogen and phosphorus concentrations. Waste sludge was mixed with citrus peel and processes as a cattle feed additive in the existing facilities. The waste activated sludge represented approximately
1.5 percent of the total cattle feed production on a dry weight basis. Treatment plant effluent was reused for barometric leg and cooling water and was then discharged. Annual treatment cost was estimated at \$56,000 for investment costs (at 8% interest) and an average of approximately \$60,000 for operating costs. However, reuse of the treated water also resulted in a \$15,000 annual savings which was not reflected in the preceding cost analyses. (Lowry-Texas) W72-10223

MECHANISMS OF BIOLOGICAL LUXURY PHOSPHORUS UPTAKE.

Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.

Copy available from GPO Sup Doc, \$1.00; microfiche from NTIS as PB-210 465, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, November 1971. 77 p. 17 fig, 20 tab, 39 ref. EPA Program 17010 DDQ 11/71.

Descriptors: \*Activated sludge, \*Phosphorus, \*Metabolism, Tracers, Bacteria, Temperature, Inhibition, Laboratory tests, Analytical techniques, Waste water treatment.

Identifiers: \*Luxury uptake, Rilling Road Sewage Treatment Plant (Tex), San Antonio (Tex), Tucson

Activated sludges obtained from the Rilling Road plant located at San Antonio, Texas and from the Hyperion treatment plant located at Los Angeles, California have the ability to remove large amounts of phosphorus from Tucson sewage and other liquors by means of biological mechanisms. Most of the phosphorus seems to accumulate within the sludge cells as orthophosphate. Tucson sludge seems to take up phosphorus by biological mechanisms but removes considerably less from its medium than does Rilling sludge. However, phosphorus uptake by Tucson sludge is improved if the sludge is starved prior to the addition of sewage. The bacteria isolated from Rilling sludge do not individually seem to account for a high phosphorus affinity when compared to those from Tucson sludge. A culture of Sphaerotilus natans was isolated from Rilling but not from Tucson sludge. This organism had a higher affinity for phosphorus than others tested but not sufficient to account for the superior removal properties ex-hibited by the Texas sludge. A known sludge bacterium, Zoogloea ramigera formed volutin granules when excess orthophosphate was added to a phosphate starved culture. However, the conditions necessary to produce these granules in this organism probably do not exist in normal sewage. (Lowry-Texas) W72-10224

WHEY EFFLUENT PACKED TOWER TRICK-LING FILTRATION. Quirk, Lawler and Matusky Engineers, New

Copy available from GPO Sup Doc, \$1.50; microfiche from NTIS as PB-210 408, \$0.95. Environmental Protection Agency Water Pollution Control Research Series, September 1971, 179 p., 33 fig, 30 tab, 39 ref. EPA Program 12130 DUJ 09/71. Descriptors: \*Trickling filters, \*Dairy industry, \*Laboratory tests, Industrial wastes, Kinetics, Computer models, Biodegradation, Municipal wastes, Operation costs, Construction costs, Activated sludge, Cost comparisons, Waste water Identifiers: \*Whey effluent.

A theoretically based analysis of BOD removal A theoretically based analysis of BOD removal during flow over an inclined plane and during flow through full-scale trickling filter media has been developed and verified by application to laboratory and full-scale data. The treatability of whey effluent has been demonstrated both by testing with the theoretical model and by comparison with fluent has been demonstrated both by testing with the theoretical model and by comparison with other industrial effluent of known treatability. A computer program was developed for whey treatment, handling series or parallel filtration using one to three stages. The ranges of operating parameters tested were: BOD 200 to 600 ppm; pH 4.5 to 9.8; and temperature 15 to 30 deg C. Filter performance responded primarily to flow changes. Secondary sludge was amenable to thickening by gravity compaction and dewatering by vacuum filtration. Centrifugation was not effective. Combined Village of Walton domestic wastes and whey wastes as of the 1990 projections would comprise wastes as of the 1990 projections would comprise
1.17 mgd containing 6860 lbs BOD and 1580 lbs of
suspended solids. A \$2,749,000 capital cost and a
\$127,000 annual operating cost are projected for a
plant to handle the combined wastes. Waste treatment in a single combined facility rather than separate, individual facilities is expected to realize a 30 to 40% cost savings. (Lowry-Texas) W72-10226

DEVELOPMENT OF A SOLID ELECTROLYTE CARBON DIOXIDE AND WATER REDUCTION SYSTEM FOR OXYGEN RECOVERY,

Westinghouse Electric Corp., Pittsburgh, Pa. L. Elikan, J. P. Morris, and C. K. Wu. Available from the National Technical Information Service as NASA CR-2014, \$3.00 in paper copy, \$0.95 in microfiche. National Aeronautics and Space Administration, Contractor Report No. CR-2014, May 1972. 169 p, 57 fig, 30 tab, 23 ref.

Descriptors: \*Oxygen requirements, \*Carbon dioxide, \*Laboratory tests, Prototype tests, Electrolysis, Electrolytes, Catalysts, Currents, Resins, Humidity, Temperature, Instrumentation, Automatic control, Reliability, Analytical techniques, Operation and maintenan

A 1/4-man solid electrolyte oxygen regeneration system, consisting of an electrolyzer, a carbon deposition reactor, and palladium membranes for separating hydrogen, was operated continuously in a 180-day test. Selection of the solid electrolyte system for testing and development was based on:
(1) flexibility in handling mixtures of CO2 and water in any ratio; (2) ease of control; (3) absence of need for gas-liquid separation; (4) absence of need for a separate water electrolysis unit; and (5) fewer interfaces. Oxygen recovery from the car-bon dioxide-water feed during the test averaged 95%. One % of the oxygen was lost to vacuum along with the hydrogen off-gas. In a space cabin, the remaining 4% would have been recycled to the tne remaining 4% would have been recycled to the cabin and recovered. None of the electrolysis cells used in the 180-day test failed. Electrolysis power rose 20% during the test; the average power was 238.5 wats/man. Crew time was limited to 18/min/day, 12 of which were used for removing carbon. (Lowry-Texas) W72-10227

PHOSPHATE REMOVAL BY RECIRCULATING

IRON SLUDGE, Zurich Univ. (Switzerland).

Land Carlon Services of the Control Federation, Vol 44, No 2, February 1972, p 176-182. 4 fig, 6 ref.

Descriptors: \*Phosphorus, \*Chemical precipita-tion, \*Tertiary treatment, Iron compounds, Ac-

### **Group 5D—Waste Treatment Processes**

tivated sludge, Sedimentation, Solubility, Cost analysis, Sludge, Waste water treatment. Identifiers: \*Ferric chloride.

A recirculating iron sludge phosphorus elimination process (the Thomas Process) involves the use of small amounts of fresh ferric chloride and iron phosphorus sludge, which if used separately, would produce negligible results. Previous testing has demonstrated that removals of up to 95% of the influent phosphorus have been achieved using the Thomas Method. The Thomas Method also has the advantage of being stable under the following conditions: (1) if the influent to the mechanical plant brings phosphate rich wastewater, the surplus sludge that is discharged precipitates phosphate; (2) if the mechanical plant effluent brings phosphate rich wastewater to the biological plant, most of the phosphate gets bound in the preremoval, and the remaining part is eliminated by the addition of the precipitant; (3) if the activated sludge basin influent is phosphate poor the added precipitant cannot be used entirely, but precipitates as sludge and, after its introduction in the activated sludge plant, is able to remove large quantities of phosphate. By obtaining ferric chloride from the waste products of metal galvanizing industries, costs of phosphate removal can be reduced to \$0.46/cap/year based on 500 liters/capita/day. (Lowry-Texas) W72-10228

### EL PASO LOSES DRYING BEDS IN BOUNDA-RY ACTION.

Water and Sewage Works, Vol 117, No 2, February 1970, p 26-27.

Descriptors: \*Sludge treatment, \*Sludge disposal, \*Centrifugation, \*Dewatering, Construction costs, Treatment facilities, Operating costs, Flocculation, Efficiencies, Texas.

Identifiers: \*Composting, Soil conditioner, Herco Floc 810, Dosages, El Paso (Tex).

With the signing of the Chamizal Treaty between the United States and Mexico the Delta Street sewage treatment plant located in El Paso, Texas was required to change its technique of sludge dewatering for the land on which its sludge drying beds were located was awarded to Mexico. An engineering study indicated that mechanical dewatering was most feasible, and a centrifuge installation was finally selected at a cost of \$200,000. The centrifuges made by Bird Machine Company, utilize a concurrent flow design, and have a nominal sludge handling capacity of 75 gpm of digested sludge at a feed concentration of 6 or 7 percent solids with the produced cake having 20-22 percent solids. It was reported that two centrifuges can handle sludge from the contributing population of 230,000 on a 35 hour per week schedule. Approximately 90 percent recovery of solids was obtained at flocculant dosages of approximately 2-3 lb/ton of dry solids. Herco Floc 810, by Hercules Chemical Company was used as the flocculant. The dewatered sludge was mixed with wood shavings and sawdust ob-tained from local planing mills and composted for 8 to 12 weeks in windrows three to four feet high. The product was sold as a soil conditioner at \$3.50/cu, vd. This system was the first of its kind in Texas and income from the facility results in significant reduction to the overall cost of operat-ing the system. (Galwardi-Texas) W72-10229

THE ORBAL EXTENDED AERATION ACTIVATED SLUDGE PLANT,
National Inst. for Water Research, Pretoria (South

Africa).

R. L. C. Drews, W. M. Malan, P. G. J. Meiring, and B. Moffatt.

Journal Water Pollution Control Federation, Vol 44, No 2, February 1972, p 221-231. 6 fig, 5 tab, 4 Descriptors: \*Domestic wastes, \*Activated Sludge, \*Aeration, Operation and maintenance, Performance, Electric power costs, Land use, Sludge disposal, Cost analysis, Waste water treat-

Identifiers: \*Orbal system, \*Rotating disks, \*Extended aeration.

The orbal extended aeration modification to the activated sludge process utilizes a multi-compartment system, without intermediate sludge settling and return, in which the first channel (if correctly sized) acts as a shock absorbing completely mixed unit, and subsequent channels help to avoid shortcircuiting and cause the flow characteristics to approach those of plug flow. Aeration is provided by rotating perforated disks which can be raised or lowered to provide the precise amount of aeration desired, or the number of disks can be decreased or increased for the same reasons. Power consumption has been estimated at \$0.028/1000 gal at \$0.011/Kwh, with only plus or minus 10 W/M3 required to maintain sludge in suspension. Further cost advantages are realized by elimination of primary settling facilities, lower construction costs of shallow channeled designs, and smaller-sized sludge drying bed facilities. Effluent quality and sludge dewaterability have both been excellent. The most suitable application range appears to be in communities of less than 4000 population. (Lowry-Texas) W72-10230

LAYING NEW SEWERLINES. TWO OF GREATER VANCOUVER'S EXPERIENCES MAY BE HELPFUL.

Water and Sewage Works, Vol 117, No 8, August 1970, p 264-265.

Descriptors: \*Sewers, \*Construction joints, Construction materials, Concrete pipes, Pollution abatement, Public utilities, Sewage districts. Identifiers: Vol-i-ver gaskets, Revo-Lok gaskets, Vancouver (British Columbia)

Solutions are presented to two problems faced by Vancouver, British Columbia, that of laying larger sewer pipelines without disrupting existing utilities and replacing septic tank connections without incurring the wrath of residents whose gardens would of necessity be torn up. One stretch of 15,000 ft. of the interceptor sewer lines required more than 100 metered corners. The contract for the interceptor line specified centrifugal spun concrete pipe and no leakage. The no-leak requirement was solved in part by the use of Vol-i-ver 'O' ring gaskets. The contract associated with the lateral connections called for careful removal and replacement of trees, shrubs, etc., and made the contractor responsible for replacing any parts of gardens disturbed. Professional garden crews were employed and worked right along with the pipelay-ing crew. The concrete pipe was laid one section at a time and Revo-Lok gaskets were used to prevent the pipe from creeping while the next section was being prepared. (Galwardi-Texas) W72-10231

BIOCHEMICAL CHANGES IN OXIDATION PONDS. Maharaja Sayajirao Univ. of Baroda (India). Dept.

of Biochemistry.
P. M. Amin, and S. V. Ganapati.

Journal Water Pollution Control Federation, Vol 44, No 2, February 1972, p 183-200, 11 fig, 5 tab,

Descriptors: \*Oxidation lagoons, \*On-site investigations, \*Bacteria, \*Algae, Oxidation, vestigations, \*Bacteria, \*Algae, Oxidation, Metabolism, Respiration, Lipids, Ammonia, Car-bohydrates, Carbon dioxide, Polymers, Hydrogen ion concentration, Protozoa, Dissolved oxygen, Sludge, Waste water treatment.

A laboratory study of the first operational stage of a wastewater lagoon, namely, the 28 day period of

non-changing environment when algae are allowed to develop naturally, showed that this stage is separated into two distinct phases, the bacterial Phase I and the algal Phase II. The most notable findings were: (1) absence of acidity in both phases; (2) absence of dissolved oxygen in Phase I and its abundance in Phase II; (3) large reductions in coliform density; (4) large increases and decreases in biochemical constituents, such as sugars, in Phase I and Phase II, respectively; (5) increases in fatty substances and chlorophylls; (6) large protozoa population in Phase I compared to large algal populations in Phase II; and (7) lack of appreciable sludge formation. Carbohydrate usage mostly for synthesis of fatty substances and much less for polymer accumulations within cells, resulted in more fat in the clear final effluent, thus explaining the absence of sludge in the ecosystem.
(Lowry-Texas)
W72-10233

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DESIGN AND OPERATION OF THE WORKS OF THE BASINGSTOKE DEPARTMENT OF WATER POLLUTION CONTROL,

Basingstoke Borough Dept. of Water and Pollution Control (England).

H. Dixon, B. Bell, and R. J. Axtell. Water Pollution Control, Vol 71, No 2, 1972, p 167-173. 4 fig, 2 tab.

Descriptors: \*Activated sludge, \*Design criteria, \*Operation and maintenance, Screens, Sedimentation, Aeration, Storm runoff, Sludge digestion, Sludge disposal, Waste water treatment. Identifiers: \*Microstrainers.

Because of the larger land requirements, greater working head required, and higher capital cost of biological filters, a new treatment plant for the Borough of Basingstoke was designed for diffused air aeration activated sludge. Design population was 80,000, with capability of expansion to 96,000 since the design was based on modules of 16,000 population to facilitate construction in stages and provide for maximum flexibility of operation. The design sewage dry weather flow was 3 mgd with a maximum flow to full treatment of 7.8 mgd. Principal components of the works include screens, detritor, separating weir, storm tanks, primary settlement tanks (290 gal/ft2-day surface loading), aeration tanks, (7.25 hours DWF capacity), secondary sedimentation tanks, microstrainers, primary digestion tanks, secondary digestion tank, sludge thickening tanks, and sludge disposal on agricultural land. The works was put in operation on 11 April 1967. A summary of the operational problems encountered, as well as remedial actions taken, is presented. (Lowry-Texas) W72-10234

PRESSURE SEWER DEMONSTRATION PRO-

JECT, New York State Dept. of Environmental Conservation, Albany. For primary bibliographic entry see Field 08C. W72-10235

EFFECT OF HEAVY METALS ON ANAEROBIC DIGESTION AND THE ROLE OF REGULATORY AGENCY WHEN MUNICIPAL SEWAGE

RY AGENCY WHEN MUNICIPAL SEWAGE TREATMENT PLANT IS UPSET, Lexington Dept. of Water Pollution Control, Ky. T. M. Regan, and M. M. Peters. Proceedings, Industrial Waste Conference, 25th, May 7-9, 1970, p 645-651. 2 fig, 3 tab.

Descriptors: \*Sludge digestion, \*Toxicity, \*Heavy metals, Industrial wastes, Sulfides, Lime, Hydrogen ion concentration, Ammonia, Methane, Analytical techniques, Sampling, Activated sludge, Waste water treatment. Identifiers: \*Digester failure, \*Volatile acids

ne digestion system of the main Lexington Wastewater Treatment Plant receives some 75,000 gal/day of sludge with a 6 to 8% total solids content from the primary clarifiers of a 12 mgd Kraus Modified Activated Sludge Plant. The system's two digesters, which receive sludge every 4 hours, produce 200,000 ft3 of digester gas daily which comprises 85% of the plant's fuel requirements. In addition, provision of usable supernatant is essentiated to the former of the tial to the operation of the Kraus process. On August 31, 1967, a toxic slug destroyed gas produc-tion in both digesters. It was impossible to drain the digesters and restart, so corrective measures were instituted while the plant remained in operation. The Kraus process was discontinued and the plant was operated as a conventional activated sludge plant, with 8 mgd receiving both primary and secondary treatment, and 4 mgd receiving only primary treatment and chlorination. 211 days of emergency operation were necessary before conventional operation was possible. In efforts to avoid future occurrences: (1) a regular industrial waste sampling program was instituted; (2) the appropriate sewer use ordinance is under study for revisions to strengthen the industrial wastes section; (3) a sodium sulfide supply is kept in stock; and (4) a complete laboratory for toxic metal determinations and capability for incineration of raw or digested sludge is being planned. (Lowry-Texas) W72-10236

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#### REMOVAL OF ALGAE FROM WASTE STA-BILIZATION POND EFFLUENTS--A STATE OF THE ART.

Illinois State Water Survey, Urbana.
V. Kothandaraman, and R. L. Evans.
State of Illinois Department of Registration and

State of Illinois Department of Registration and Education Circular No 108, 1972. 9 p, 3 fig, 1 tab, 16 ref

Descriptors: \*Oxidation lagoons, \*Harvesting of algae, \*Separation techniques, Chemical precipitation, Coagulation, Sedimentation, Polyelectrolytes, Lime, Neutralization, Filtration, Centrifugation, Vacuum drying, Flotation, Wastewater treatment. Identifiers: \*Agglomeration.

Uni-algal cells have been found to carry a negative charge at pH between 2 and 11. At pH 2 and pH 11, the algal cells possess a very high charge density, while at pH 7 a very low negative charge density is exhibited. Chemical precipitation of algae has been postulated as being due to charge neutraliza-tion, agglomeration, and sedimentation. Algae handling in the removal process consists of con-centration of algal cells from 200-4000 mg/l to 1 to 4% by weight, dewatering the 1 to 4% mixture to between 8 and 20%, and drying the 8 to 20% mix-ture to an 85 to 90% mixture of algal cells. Chemical coagulants, particularly lime, alum, ferric salts and cationic polymers, are effective in causing coagulation and sedimentation of algal cells. Dewatering and drying of algal slurries from the con-centration step can be most economically achieved by sand bed application. Vacuum filtration has been only partially successful, while centrifuga-tion has been too expensive. A market for sewagegrown algae as livestock feed has yet to develop, but use as a soil conditioner has been suggested and other conventional disposal methods are being investigated. (Lowry-Texas) W72-10237

RECYCLING AND ECOSYSTEM RESPONSE, Michigan State Univ., East Lansing. Inst. of Water

For primary bibliographic entry see Field 06G. W72-10323

EFFECT OF CALCIUM BICARBONATE ON DISINFECTION BY HALOGENS, Massachusetts Univ., Amherst. Dept. of Civil En-

gineering. For primary bibliographic entry see Field 05F. W72-10370 ANALYSIS OF ALKALINE PULPING LIQUOR WITH SULFIDE ION-SELECTIVE ELECTRODE,

Foxboro Co., Mass. J. L. Swartz, and T. S. Light. Tappi, Vol 53, No 1, January 1970, p90-95. 10 fig, 2 tab. 23 ref.

Descriptors: \*Sulfides, \*Sulfite liquors, \*Pulp and paper industry, Analytical techniques, Monitoring, Electrodes, Instrumentation, Permselective membranes, Hydrogen ion concentration, Temperature, Laboratory tests, Oxidation, Sulfur compounds, Water quality control.

Laboratory tests have demonstrated the silver sulfide membrane electrode to be a useful analytical tool in determination of free and total sulfide in alkaline pulping liquors, as well as a useful aid in the study of sulfide distribution in such liquors. Argentimetric titrations and back titrations of black pulping liquor were performed in the presence of 1.0 M NH4PH. Direct titration gave total inorganic sulfide and back-titration gave the sum of total inorganic and organic sulfide. Errors due to reduction of silver ion by polysulfides and aromatic polyhydroxy compounds were observed. A series of room temperature oxidations of alkaline sulfide solutions was carried out using both air and oxygen at several flow rates, while electrodes responsive to sulfide, oxidation-reduction potential, and pH were used to continually monitor oxidation progress. The electrode's ability to selectively sense free sulfide ions at very low concentrations, together with its rapid response time and freedom from interferences, suggest its profitable application in the continuous monitoring and control of sulfide in alkaline pulping liquors. (Lowry-Texas)

CAPITAL AND OPERATING COSTS--AWT, Cornell, Howland, Hayes and Merryfield/Hill, Corvallis, Oreg. D. R. Evans, and J. C. Wilson.

Journal Water Pollution Control Federation, Vol 44, No 1, January 1972, p1-13. 1 fig, 19 tab, 4 ref.

Descriptors: \*Water pollution control, \*Water reuse, \*Tertiary treatment, Cost analysis, Chemical precipitation, Filtration, Activated carbon, Adsorption, Nitrogen, Phosphorus, Ammonia, Lime, Neutralization, Sludge, Activated sludge, Waste water treatment.

Identifiers: \*South Lake Tahoe (Calif).

Advanced waste treatment methods have been utilized at South Lake Tahoe, California, to further improve on conventional activated sludge secondary effluent, and produce a valuable water resource for recreation, irrigation, and perhaps direct reuse. Methods used include lime precipitation of phosphorus from secondary effluent, with subsequent lime recalcination, ammonia stripping, recarbonation, mixed-media filtration, and carbon adsorption with subsequent carbon regeneration. Total costs in 1969 were \$172/million gallons for onventional treatment and \$212/million gallons for advanced waste treatment, both figures including capital and operating costs for treatment of 7.5 mg of municipal wastes. Product water contained less than 0.21 mg/l MBAS, 2.9 mg/a BOD, 16.9 mg/lCOD, 1.2 mg/l turbidity, and 0 mg/l suspended solids for 100% of plant operating lime. (Lowry-Texas)

INFLUENCE OF WASTE PAPER ON AEROBIC SLUDGE DIGESTION,
Texas Western Coll., El Paso. Dept. of Civil En-

Texas Western Coll., El Paso. Dept. of Civil Engineering.
A. J. Tarquin, and R. Zaltzman.

A. J. Tarquin, and R. Zaltzman. Public Works, Vol 101, March 1970, p80-82. 5 fig, 4 ref

Descriptors: \*Solid wastes, \*Sludge treatment, \*Sludge digestion, \*Aerobic treatment, Chemical

oxygen demand, Hydrogen ion concentration, Ammonia, Carbon, Nitrogen, Efficiencies, Performance, Temperature. Identifiers: \*Paper, Loading rate, Percent solids, Detention time, Oxygen uptake rate.

A laboratory investigation of the influence of waste paper on the aerobic sludge digestion process was conducted with three variables, temperature, detention time, and paper loading rate being studied. Detention times of 10, 15, 30, and 60 days were studied at temperatures of 15, 25, and 37C. The primary sludge was controlled to 3 percent solids and paper was added at rates of 10, 25, 50, and 100 percent of the sludge solids. High concentrations of waste paper did not affect the efficient digestion. The addition of waste paper to primary sludge increased the carbon to nitrogen ratio, resulting in an increased biomass and increased nitrogen assimilation with resultant increases in oxygen uptake rates and efficiency. Significant amounts of nitrogen were lost through air stripping of ammonia. PH values of 7.0 and 7.2 were noted for the 10 and 15 day detention times while a pH value of about 5 was noted for both the 30 and 60 day detention times. Increases in temperature and paper loading rates resulted in increases in solids reduction. Volatile solids were removed most rapidly during the first 10 days. Also, as the paperloading rate was increased from 10 to 100 percent of the total solids, the amount of COD removed increased for each detention time studied. (Galwardi-Texas)

PRESENT PRACTICE AND NEW CONCEPTS FOR HANDLING EFFLUENTS FROM HOT ROLLING MILLS,

Hydrotechnic Corp., New York.

R. Nebolsine. Iron and Steel Engineer, Vol 47, No 8, p 85-92, August 1970. 7 fig, 6 ref.

Descriptors: \*Industrial wastes, \*Steel, Cost analysis, Analytical techniques, Economics, Waste water treatment, Water pollution sources, Treatment facilities, Mineral industry, Oils, Quality control, Water reuse, Design criteria.

Identifiers: \*Iron and steel industry, Iron and steel

Current methods of treating effluents from hot rolling mills require the use of scale pits, either mechanical or two-stage. Scale pits are required to handle effluents consisting of particles of iron oxide and steel, oils, mill scale, and grease. The volume of water treated varies depending on the methods of production used. Although the two designs of scale pits allow for adequate treatment, the need for improved effluent quality brings about a corresponding need for improved methods of treatment. The new methods should meet the following standards: (1) radical improvement of the quality of the effluent so that it can be recirculated within the plant and also satisfy present and future effluent quality standards, (2) recovery of nearly all mill scale produced, (3) reduction of the need for continuous operating labor or supervision, (4) concentration and automatic delivery of the intercepted oils and sludges to the special facilities for reclamation or disposal, (5) lowering of construction and operating costs. A new 3-step process is being considered which would require construction of new facilities. The expense could be partially offset, however, by economic return resulting from the improved treatment methods. (Atkins-Texas)

NUTRIENT REMOVAL BY NATURAL GAS FERMENTATION, British Columbia Research Council, Vancouver.

British Columbia Research Council, Vancouver Div. of Applied Biology. J. C. Mueller.

Journal Water Pollution Control Federation, Vol 44, No 1, January 1972, p 25-33. 4 fig, 10 tab, 13 ref.

### **Group 5D—Waste Treatment Processes**

Descriptors: \*Nutrients, \*Municipal wastes, \*Separation techniques, Fermentation, Nitrogen, Phosphorus, Ammonia, Methane, Temperature, Hydrogen ion concentration, Protein, Laboratory tests, Cost analysis, Algae, Waste water treat-

Nitrogen and phosphorus were removed from secondary waste treatment plant effluents by fermentation of gaseous hydrocarbons to assimilate both nitrogen and orthophosphate into a bacteria cell mass. In laboratory tests, 93 to 100% of the nitrogen and 98 to 99% of the phosphorus were recovered in the form of a protein rich biomass. This biomass was shown to contain 60 to 70% protein, indicating that one possible outlet for the product could be animal fodder or feed supple-ments. At present efficiencies, as indicated in the laboratory tests, production costs of the biomass protein were estimated at 25% more than the cost of commercially available animal feed supplements. (Lowry-Texas)
W72-10390

AID FOR WASTEWATER COLLECTION

New York State Dept. of Environmental Conservation, Albany. Div. of Pure Waters.
N. H. Nosenchuck.

Journal Water Pollution Control Federation, Vol 44, No 1, January 1972, p 129-133. 2 tab, 4 ref.

Descriptors: \*Sewerage, \*Grants, \*Government finance, New York, Administration, Budgeting, Planning, Financing, Operation and maintenance, Water pollution abatement, Waste water treat-

Chapters 1045 and 1046, Laws of New York of 1970, have established a major addition to New York State's Pure Waters Program. This legislation was drafted and adopted to fill the void left by a lack of federal assistance for the construction of municipal wastewater collection systems. The state aid is based on the number of residences served by the project and is computed based on the formula: state aid = (a/b) x (c) - \$125 b, where a = number of sewer connections serving re-sidences, b = number of total sewer connections, and c = the municipalities total annual operating costs. This aid is aimed at assisting smaller communities when their local economics and tax bases are insufficient either to generate construction of wastewater collection systems or to finance these systems adequately when constructed. State aid is made available to a municipality through participa-tion in annual debt service established by contracts entered into between the commissioner of Environmental Conservation and the municipalities. (Lowry-Texas) W72-10391

CONTROL OF THIOTHRIX IN ACTIVATED

SLUDGE, Wisconsin Univ., Madison. Dept. of Civil En-

gineering. G. J. Farquhar, and W. G. Boyle. Journal Water Pollution Control Federation, Vol 44, No 1, January 1972, p 14-24. 13 fig, 4 tab, 8 ref.

Descriptors: \*Activated sludge, \*Sulfides, \*Sedimentation, Aeration, Microorganisms, Metabolism, Oxidation, Separation techniques, Sludge, Laboratory tests, Pilot plants, Waste water treat-

Identifiers: \*Sludge volume index, \*Bulking.

A six-stage laboratory scale pilot plant experiment was conducted to determine the effects of sulfide concentrations on the growth of Thiothrix, and the concentrations on the growth of Thiothrix, and the effects of Thiothrix growth on activated sludge bulking. Phase I involved continuous system operation for 23 days with an aeration tank detention time of 6.2 hours; Phase II involved preaeration of the influent for 18 days; Phase III involved a 21 day repetition of Phase I; Phase IV was a 26 day repetition of Phase II; Phase V included basic correction with presention and ulfid dediction. operation with preaeration and sulfide addition;

and Phase VI was a repetition of Phases II and IV in an attempt to reduce sulfide concentrations and decrease sludge bulking. Low sulfide concentra-tions did limit Thiothrix growth and reduce bulking tendencies. Methods of reducing sulfide ion other than preaeration might also control Thiothrix bulking, but would probably be ineffective with bulking caused by other microorganisms. (Lowry-Tex-W72-10392

RESULTS OF A DEMONSTRATION AND OTHER STUDIES OF THE DISPOSAL OF HIGH LEVEL SOLIDIFIED, RADIOACTIVE WASTES IN A SALT MINE, Oak Ridge National Lab., Tenn.

R. L. Bradshaw, F. M. Empson, W. C. McClain, and B. L. Houser

Health Physics, Vol 18, 1970, p 62-67. 1 fig, 17 ref.

Descriptors: \*Radioactive waste disposal, \*Ultimate disposal, \*Radioactivity effects, \*Economics, Capital costs, Operating costs, Nuclear power plants, Temperature, Creep, Plastic, Deformation, Kansas.
Identifiers: \*Salt mines, Demonstration project,

Lyons (Kans).

The radioactive phase of the demonstration disposal of high-level radioactive wastes in the Carey Salt Company's Lyons, Kansas mine was completed in June 1967 and the mine was placed on standby basis in February 1968. During the 19month operation of the radioactive demonstration the average dose to the salt over the length of the radioactive container holes was about 8 x 108 rads, and the peak dose was about 109 rads. Doses dropped off very rapidly with distance out into the salt, with doses at 6 inches into the salt being only about 108 rads. Radiophotolumenescent glass rods were used for most of the measurements. The feasibility and safety of handling highly radioactreasurity and safety of natural gangly radioactive materials in an underground environment was demonstrated. The stability of the salt under the effects of radiation and heat with temperatures reaching a level of 200C was shown. A mine disposal facility can be designed with the data obtained on the creep and plastic flow characteristics of the salt. A study of the economics of disposal in salt mines indicated that this method would be compatible with competitive nuclear power. The calculated cost per kilowatt-hour of electricity generated ranged from about 20 x 10-3 Mill for wastes aged 1 year and 30 years, respectively. Therefore, from the standpoint of economics, it would be practical to dispose of wastes in salt at 3-4 years out of the reactor. (Galwardi-Texas) W72-10399

POLYMER AIDS IN DEWATERING AND ELUTRIATION,

District of Columbia Dept. of Sanitary Engineer-Ing, Washington. Water Pollution Control Plant.
B. W. Dahl, J. W. Zelinski, and O. W. Taylor.
Journal Water Pollution Control Federation, Vol 44, No 2, February 1972, p 201-211. 6 fig, 2 tab.

Descriptors: \*Activated sludge, \*Dewatering, \*Polyelectrolytes, Flocculation, Filtration, Vacuum drying, Separation techniques, Research and development, Cost analysis, Operation and maintenance, Sludge, Waste water treatment, District of Columbia. Identifiers: \*Elutriation

The use of synthetic organic polyelectrolytes in elutriation and sludge dewatering has increased the capture of solids in elutriation from 57% to 92% at the District of Columbia's wastewater treatment plant. The original elutriation system had functioned well until waste activated sludge was added to the primary sludge being fed when the activated sludge plant was started-up in 1959. Experimental use of polyelectrolytes was started in 1961, and by 1963, C-31 cationic polymer and A-21 anionic polymer were found to work successfully in conjunction with one another when applied at sequential points in the sludge flow. After several years of experiments and much further testing, SA 1767 and ferric chloride are now being used because of their lesser cost. The resulting improvement in elutriate clarity has enabled the plant to tolerate recycle of this waste liquor, reducing the plant effluent BOD from 134,000 lb/day to 100,000 lb/day and the suspended solids from 172,000 lb/day to 100,000 lb/day. This improve-ment has been achieved at a cost of \$2.57/million gallons of wastewater treated, based on an annual average flow of 253 mgd. (Lowry-Texas) W72-10400 loa

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SEQUENTIAL PROCESSING IN WATER LAGOONS, Arizona State Univ., Tempe. WASTE-

J. W. Klock.

Journal Water Pollution Control Federation, Vol 44, No 2, February 1972, p 241-254, 12 fig, 3 tab, 5

Descriptors: \*Oxidation lagoons, \*Channels, \*Heat transfer, \*Plastics, Domestic wastes, Bacteria, Algae, Nutrients, Oxidation-reduction potential, Odors, Operation and maintenance, Waste water treatment.

A reliable and simply operated lagoon, incorporating the principles of heat conservation, sequentialphase processing, and utilization of thin plastic films to form channel barriers and heat transfer surfaces, was developed. The construction of the system included the use of channels constructed of black polyethylene sheets. The influent to the system flowed into the lagoon in the lower Phase I, and the Phase II channels of the black polyethylene floated on the surface of the Phase I liquid. This arrangement effectively prevented heat loss directly to the atmosphere above the Phase I liquid, and the thin plastic material allowed heat exchange from the lower phase to the upper phase. Phase I was designed as strictly a bacterial. phase. Phase I was designed as strictly a bacterial phase to prevent premature algae growth and sub-sequent nutrient fixation, with Phase II intended as an algal phase followed by limited growth of crustaceans and aquatic insects. Average BOD reduction was 76.8%, with minimal surface solids and no odors. Associated operational problems and solutions are presented. (Lowry-Texas) W72-10401

OXYGENATION AND HIGH-RATE BIOLOGICAL TREATMENT PROCESS,

Rhode Island Univ., Kingston. C. P. C. Poon, and K-K. Wang.

Journal Water Pollution Control Federation, Vol 44, No 2, February 1972, p 265-273. 6 fig, 2 tab, 20

Descriptors: \*Aeration, \*Air, \*Oxygen, \*Biodegradation, Activated sludge, Organic loading, Respiration, Oxygen requirements, Mass transfer, Oxygenation, Sludge disposal, Cost analysis, Waste water treatment.

Identifiers: \*Endogenous respiration, \*Oxygen

tension

Monod kinetics implies that the oxygen tension in a successfully operating biological system is above a critical concentration level. Previous investiga-tions with high solids level wastes have indicated that the oxygen demand of high solids wastes may exceed the capacity of conventional aeration. Laboratory studies were conducted on activated sludge from domestic wastes, where additions of pure oxygen, rather than air, were made to determine whether the results implied in the Monod system could be altered. At loadings of 1.0, 2.0, and 3.0 mg COD/mg Mixed Liquor Suspended Solids (MLSS)/I, both the substrate removal rate and the endogenous respiration rate were enhanced. Optimal process loading for a system using 10.0-g/l MLSS in the aeration tank was between 2.0 and 3.0. A cost analysis showed the conventional aeration and pure oxygen systems to be nearly equal in cost at the 2.0 loading, with conventional aeration becoming more economical as loadings decrease and pure oxygen becoming more economical as loadings increase. For a 1.0-mgd treatment plant operated at a loading of 3.0, an annual savings of over \$126,000 was indicated. (Low-

CONTACT STABILIZATION IN SMALL PACKAGE PLANTS, Iowa Univ., Iowa City. R. R. Dague, G. F. Elbert, and M. D. Rockwell. Journal Water Pollution Control Federation, Vol 44, No 2, February 1972, p 255-264. 11 fig. 3 tab, 6

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tem the Descriptors: \*Activated sludge, \*Design criteria, \*On-site investigations, Aeration, Respiration, Absorption, Adsorption, Mixing, Biodegradation, Organic loading, Biochemical oxygen demand, Suspended solids, Waste water treatment. Identifiers: \*Contact stabilization, \*Package

Investigation with contact stabilization package treatment plants as currently designed has demonstrated that such facilities are unstable under conditions other than 24 hour operation. Two contact duons other than 24 hour operation. I we contact stabilization plants currently having operational difficulties were modified, one to the conventional activated sludge process and the other to complete mix operation. The difficulties encountered by the contact stabilization stemmed mainly from flow variations, and the fact that most plants are designed for a 3-hour contact time rather than the 15 to 30 min. contact time originally developed. The wide variability of the municipal waste flow for the first system evaluated caused the wastes in the contact zone to have a retention time varying from 2 to 8 hours. Each of the other plant opera-tions was similarly affected. The trouble which arose then, was mainly in separating the solids from the effluent, which became nearly impossible. After modification, the two plants functioned extremely well, producing effluents of 13 mg/l or less of BOD and 12 mg/l or less of suspended solids. (Lowry-Texas) W72-10403

OPERATION AND PERFORMANCE OF PACKAGE TREATMENT PLANTS, Greater Cincinnati Metropolitan Sewer District,

Journal Water Pollution Control Federation, Vol 44, No 2, February 1972, p 274-292. 5 fig, 10 tab, 8 ref. G. G. Seymour.

Descriptors: \*Waste water treatment, \*Planning, Descriptors: "waste water treatment, "rianning, "Administration, Domestic wastes, Design criteria, Operation and maintenance, Per-formance, Aeration, Sewers, Storm runoff, Infil-tration, Scum, Odors, Chlorination, Sludge.

Identifiers: "Noise, "Public relations, Cincinnati

An operations review, including review of case studies of three of the District's package plants, has been conducted in Cincinnati, Ohio. Particular areas of interest in both problems and solutions were noise and odor control. Four main points were discovered during the studies: (1) a definite system of review and approval of package plant design is essential to the construction and operation of good plants; (2) workable regulations dealing with new sewer construction should be considered to eliminate some of the problems associated with infiltration and storm flow; (3) regusociated with initiation and solin inch. Polyal lations establishing maximum noise levels and criteria governing blower or compressor place-ment and necessary appurtenant equipment aimed at noise abatement should be developed by the a noise abatement should be developed by the regulatory agencies; and (4) it has been demon-strated that maintaining good public relations in the area of package treatment plant operation is a distinct asset. (Lowry-Texas) W72-10404 COLLOIDAL MATTER IN WASTEWATERS AND SECONDARY EFFLUENTS, Rutgers - The State Univ., New Brunswick, N.J. D. A. Rickert, and J. V. Hunter. Journal Water Pollution Control Federation, Vol 44, No 1, January 1972, p 134-139. 1 fig, 7 tab, 9

Descriptors: \*Colloids, \*Particle size, \*Separation techniques, Sampling, Activated sludge, Municipal wastes, Turbidity, Biochemical oxygen demand, Chemical oxygen demand, Chemical oxygen demand, Membrane processes, Centrifugation, Analytical techniques, Waste water treatment. Identifiers: \*Total organic carbon.

24 hour proportional flow composite samples of the Bernardville, New Jersey activated sludge plant effluent were collected, as were similar sam-ples of the raw influent. The solids in both the wastewater and secondary effluent were size-separated into 4 fractions by sedimentation and further centrifugation. Results demonstrated that secondary wastewater treatment decreases the concentration of colloidal organic and inorganic material. Furthermore, colloidal organic and inorganic materials account for a lesser proportion of the total solids in secondary effluent. There is also some indication that the numbers as well as total weight of the colloidal particles are decreased durweight of the comban parties are decreased during secondary treatment. Physical and chemical evidence further indicates that the colloids in the effluent are generated during the treatment process, and are not merely the same colloids passing through the process unaffected. Thus, secondary effluent colloid problems probably reflect the nature of the materials rather than a treatment increase in colloidal matter content.

DEWATERING OF WASTEWATER SLUDGE BY HEAT TREATMENT, University Coll. of South Wales and Mon-mouthshire, Cardiff. Dept. of Mechanical Engineering. J. G. Everett.

Journal Water Pollution Control Federation, Vol 44, No 1, January 1972, p 92-100. 15 fig, 9 ref.

Descriptors: \*Sludge, \*Municipal wastes, \*Heat treatment, Microorganisms, Dissolved solids, Solubility, Temperature, Filtration, Laboratory tests, Sampling, Activated sludge, Separation techniques, Waste water treatment. Identifiers: \*Specific resistance, \*Volume reduction, Primary sludge, Humus sludge.

Waste activated, primary/activated, and humus sludges from local plants treating domestic wastes were sampled, along with cold digested sludge from the treatment of mixed municipal and industrial wastes. Sampling extended over an 18 month period, during which time daily measurements on total solids and ash content for each sludge sampled were obtained. The following day each sludge was suitably manipulsed to give a 3.0% TS conwas suitably manipulated to give a 3.0% TS con-centration, and specific resistance to filtration was measured. The sludges were then heat treated at holding times ranging from 0 to 90 min. and tem-peratures ranging from 150 to 220C. Activated sludge became easily dewaterable within 40 min. at 190C, while results for primary/activated and 190C, while results for primary/activated and humus sludge were similar. Cold digested sludge, numus studge were similar. Cold digested sludge, however, had good filtration characteristics after treatment at only 160C. Final specific resistances were of the order of 10 to the eleventh power m/kg. For all sludges, specific resistance reduction by heating was achieved by destroying the bacterial structural integrity, preventing them from packing together. (I ray-Texas)

CONCENTRATION OF SLUDGES BY GRAVITY

AND PRESSURE, Ecodyne Corp., Lenexa, Kans. Smith and Love-B. L. Goodman, and R. B. Higgins.

Proceedings, Industrial Waste Conference, 25th, May 7-9, 1970, p 383-388, 8 fig.

Descriptors: \*Sludge treatment, \*Dewatering, \*Equipment, Treatment facilities, Gravity, Pressure, Performance, Sludges, Polyelectrolytes,

Identifiers: Smith and Loveless Sludge Concentra-tor, Sludge conditioning, Cationic polymers, Thickening, Dewatering rate, Types of sludges.

The S and L Sludge Concentrator uses a sludge feed pump, polymer feed and mixing system, high rate thickener, two stage dewatering unit, and three compression rollers during the second stage to greatly increase the solids content of waste sludges while taking maximum advantage of any prior polyelectrolyte conditioning. A number of field studies have been conducted using 40 inch S and L Sludge Concentrator during which sludges from extended aeration, contact stabilization, two stages aeration. complete mixing activated sludge. stage aeration, complete mixing activated sludge, and trickling filter plants were dewatered. The performance of the high rate thickener was found to be mainly a function of the feed solids concentrabe mainly a function of the feed solids concentration. The solids handling capacity of the Concentrator was related to the concentration of solids in
the sludge applied to the gravity-pressure dewatering unit. The Sludge Concentrator dewatered
sludges with as low as 1200 mg/l solids concentration. The effects of polymer dose rates, varying
from 6-25 lb/dry ton of sludge, and 7 sludge dewatering rates varying from 100 to 400 lbs of dry
solids per hour were shown graphically, for various sludges. These data indicated that the cake
dryness of the dewatered sludge was increased by
either decreasing the rate at which the sludge is dewatered or by increasing the polymer dose rate.
(Galwardi-Texas)
W72-10409

COLOR REMOVAL FROM PAPER MILL WASTE,

Continental Can Co., Inc., Hodge, La.

E. L. Spruill.
Proceedings, Industrial Waste Conference, 25th, May 7-9, 1970, p 761-765, 4 fig.

Descriptors: \*Industrial wastes, \*Color, \*Lignins, \*Waste water treatment, \*Lime, Pilot plants, Setting basins, Carbon dioxide, Hydrogen ion concentration, Treatment facilities, Dewatering, Centrifugation, Filtration, Water reuse.

Identifiers: Calcium recovery, Kilns, Thickening,

Bench scale determinations, verified by extensive pilot plant operation, provided design criteria for a color removal system now under construction at Continental Can Company's kraft mill at Hodge, Louisiana. Color concentration in the wastewater, Louisiana. Color concentration in the wastewater, lime ratio, and the insoluble substrate upon which the color precipitate deposits were the three variables investigated. Lime required for a given percent color removal increased with initial color level by a power somewhat less than one. Clarifier designs based upon rise rates of 1.0 gpm/ft/2 were used. The sludges were found to be bulky, com-monly settling to maximum concentrations of only two to four percent solids. However, thickening by picket type devices to densities of ten percent by picket type devices to densities of ten percent has been accomplished. Results showed that a solid bowl centrifuge provided the best dewatering for the color sludge, and a conventional precoat filter was used to dewater the causticizing sludge. Calcium recovery as calcium carbonate from the clarified liquid which contains about one-half of the lime used was accomplished by reaction with carbon dioxide from the kiln stack gas. Optimum pH for the process was about 9.6. The precipitate, collected in a second clarifier, was filtered together with the kraft mill causticizing sludge. A small additional exposure to carbon dioxide served to neutralize the final effluent making it suitable for some process re-use or for bio-oxidation. All sludges were processed through the lime kiln with the fiber lignin sludge being burned and the lime recovered in this operation. (Galwardi-Texas)

## **Group 5D—Waste Treatment Processes**

REDUCTION OF BACTERIA IN SLUDGE TREATMENT

The National Institute for Public Health, Bilthoven, The Netherlands, Laboratory for

E. H. Kampelmacher, Noorle Jansen, and L. M.

Journal Water Pollution Control Federation, Vol 44, No. 2, February 1972, p 309-313, 6 tab.

Descriptors: \*Sludge, \*Bacteria, \*Public health, Vacuum drying, Filtration, Separation techniques, Bactericides, Salmonella, Pathogenic bacteria, Disinfection, Hydrogen ion concentration, Waste water treatment. Identifiers: \*Volume reduction.

Three sludge treatment plants in the Netherlands were investigated to determine whether the vacuum filtration, chemical conditioning sludge treatment method leads to a reduction in the number of aerobic microorganisms, particularly Salmonella. Results indicated that this sludge treatment method reduced the numbers of aerobic bacteria by an order of magnitude of 2 to 3. The orders of magnitude of the reduction of enterobacteriaceae ranged from 2 to 4. At all three locations, Salmonella contamination of the dry sludge was significantly less than that of the wet sludge. The reductions were assumed to be the result of the addition of chemicals, which produced a strongly alkaline medium possessing a bactericidal action. (Lowry-Texas) W72-10411

TRICKLING FILTER TREATMENT OF FRUIT PROCESSING WASTEWATERS, National Canners Association, Berkeley, Calif.

Western Research Lab.
Walter A. Mercer, and Walter W. Rose.
Copy available from GPO Sup Doc., \$0.50;
microfiche from NTIS as PB-210 586, \$0.95. Environmental Protection Agency, Water Pollution Control Research Series, September 1971, 37 p., 7 fig, 8 tab, 11 ref. EPA Program 12060 EAE 09/71.

Descriptors: \*Food processing industry, \*Fruit crops, \*Canneries, \*Trickling filters, Industrial wastes, Biodegradation, Nutrient requirements, Nitrogen, Temperature, Aeration, Dissolved ox-ygen, Pilot plants. Identifiers: \*Synthetic plastic media, \*Fruit crops.

Two high rate trickling filters were evaluated for treating fruit canning liquid wastes; one was 7.5 feet deep and had provision for heating the treated waste and for forced aeration; the other was 21.5 feet deep and was operated at ambient temperatures and with natural aeration; both were packed with a high void ratio plastic medium. Nitrogen added to the cannery waste improved the removal of BOD and COD. In the absence of added nitrogen a thick fungal slime developed with odors characteristics of anaerobic microbial action. The need for adding phosphorus was not demonstrated, more often than not, percent removals declined with increasing organic loadings; the pounds of BOD or of COD removed per unit volume increased with higher loadings. Neither elevated temperatures nor forced aeration were beneficial in the filter treatment, but increased aeration maintained higher levels of dissolved oxygen in the effluent. The top third of the 21.5 foot trickling filter accomplished 80% of the filter's total BOD removal under a light hydraulic loading. The top third removed a much higher percentage of reducing sugars than of total BOD, 67% compared to 32%. The natural aeration filter maintained a slightly higher dissolved oxygen concentration in the effluent at all three tested depths than did the experimental filter with 300 cubic feet per minute of forced aeration. Under the conditions of this study, increasing the depth of the filter medium beyond 14 ft. added very little to the filter's performance. (Lowry-Texas) W72-10412

OXYGEN THEORY IN BIOLOGICAL TREAT-MENT PLANT DESIGN

Chemspec, Bombay (India).

D. S. Mehta, H. H. Davis, and R. P. Kingsbury. Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 98, No. SA 3, June 1972, p 471-489, 5 fig, 1 tab, 29 ref.

Descriptors: \*Trickling filters, \*Biodegradation, \*Mathematical models, Performance, Oxygena-tion, Mass transfer, Flow rates, Plastics, Slimes, Absorption, Hydrogen ion concentration, Temperature, Waste water treatment.

Both theoretical and experimental analyses from several sources have demonstrated oxygen transfer to be the limiting factor in the biological oxidation process in trickling filters. A model was developed based on oxygen transfer as the limiting process, and a successful design equation for plastic media filters was derived from it. The proposed model demonstrates BOD reduction through plastic media trickling filters to be a function of hydraulic loading, filter depth, and module configuration, as well as the physical properties of the wastewater. The mechanistic equation developed and the Velz type equations and NRC empirical equations have been shown to all reflect the same limiting factor, oxygen transport. Applications of the equations to field data resulted in predicted performance values that were in close agreement to observed performance. (Lowry-Tex-W72-10413

RESEARCH NEEDS FOR ADVANCED WASTE

TREATMENT, Environmental Protection Agency, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. F. M. Middleton, and R. L. Stenburg. Journal of the Sanitary Engineering Division,

American Society of Civil Engineers, Vol 98, No. SA 3, June 1972, p 515-528, 1 fig, 2 tab, 12 ref.

Descriptors: \*Tertiary treatment, \*Water quality control, \*Research and development, Separation techniques, Filtration, Membrane processes, Flotation, Coagulation, Chemical precipitation, Activated carbon, Adsorption, Reverse osmosis, Ion exchange, Sludge disposal, Incineration, Disinfection, Cost analysis, Waste water treatment.

With the concept of minimum pollution discharge from controllable sources rapidly approaching, much time and money is being expended on the development of advanced physical-chemical waste treatment processes. For organics removal, such innovations as granular activated carbon adsorption, pure oxygen supplies for biooxidation, and light-catalyzed chlorine or ozone oxidation, are either in use or are being rapidly developed. Demineralization techniques using ion exchange and reverse osmosis, are also being refined for ap-plication in the near future. Adaptation of these and other treatment methods from the specialized industrial or food processing waste systems requires additional tailoring to enable them to withstand the peculiarities of municipal wastes. Although increased treatment to meet quality requirements increases costs, only 20% of the total per capita costs for treatment works for conveying and treating wastewater is attributable to the process used. Therefore, the best available processes can be afforded. Since effluent quality requirements extending from pollution control ob jectives to potable water reuse will dictate the degree of treatment needed, processes capable of meeting all degrees of treatment must be continually developed and refined. (Lowry-Texas) W72-10414

BASIN MANAGEMENT TECHNIQUES FOR SEWERAGE AGENCIES, Municipality of Metropolitan Seattle, Wash

For primary bibliographic entry see Field 05G W72-10415

FILTRABILITY STUDY ON SECONDARY EF-

FLUENT FILTRATION,
Neptune Microfloc, Inc., Corvallis, Oreg.
K. Y. Hsiung.
Journal of the Sanitary Engineering Division,
American Society of Civil Engineers, Vol 98, No.
SA3, June 1972, p 505-513, 3 fig. 1 tab, 10 ref.

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Descriptors: \*Filtration, \*Tertiary treatment, \*Analytical techniques, Head loss, Flow rates, Particle size, Suspended solids, Pressure, Temperature, Kinetics, Membrane processes, Separation techniques, Laboratory tests, Waste water treatment.

Identifiers: \*Standardized filtrability test, \*Secondary effluent.

The filter media and the influent suspension interact as separate systems in the filtration process. Much attention has been given to testing variations in the parameters for the media, with little or no research devoted to understanding the charac-teristics of different suspensions to be filtered. It was determined, however that one system condi-tion must be fixed in order to study the other. A specific filter media and rate was arbitrarily selected, thus fixing one of the systems. Two parameters E and R, have been derived from membrane filtration and related to the filtration efficiency and solids loading factor of a granular filter, respectively. Results indicate the E and R values can be used to specify the filtrability of a secondary effluent through a granular filter. Knowing the filtrability of an influent in terms of E and R values, filters of different designs can be evaluated and optimized. Since E and R values are independent of granular filter conditions, the information obtained would not be limited to any specific filter. Evidence demonstrating that this technique can be applied to measure the filtrability of other suspensions has been obtained, but further verification is needed. (Lowry-Texas) W72-10416

ENHANCED PHOSPHORUS REMOVAL IN TRICKLING FILTERS,

Wisconsin Univ., Madison. H. J. Jebens, and W. C. Boyle.

Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 98, No. SA 3, June 1972, p 547-560, 5 fig, 6 tab, 25 ref.

Descriptors: \*Trickling filters, \*Phosphorus, \*Chemical precipitation, Hydrogen ion concentration, Carbon dioxide, Slimes, Hardness (Water), Metals, Aeration, Biodegradation, Sludge, Analytical techniques, Design criteria, Pilot plants, Tertiary treatment, Waste water treatment. Identifiers: \*Synthetic media.

The influence of operational parameters of trickling filtration on phosphorus removals was investigated to determine whether operational modifications rather than structural modifications could produce an increase in phosphorus removals at a considerably lower cost. Four months of operation of a synthetic media trickling filter pilot plant demonstrated that slthough phosphorus removals obtained were not influenced by hydraulic loading, depth, recirculation, or waste strength, consistently greater phosphorus removals than could be attributed to biological utilization were measured. This bonus phosphorus removal was attributed to a chemical precipitation of phosphorus with cations present in the hard water wastewater. Analysis of slime samples revealed the presence of crystalline aluminum phosphate, as demonstrated by X-ray diffraction. Preserved slime samples released calcium and phosphorus in molar ratios compatible with an apatite precipitate. Release of phosphate from nonpreserved samples of filter slime suggested the presence of iron (III) phosphate precipitates. The concept of enhanced emoval of phosphates by stripping CO2, resulting in pH elevation and chemical precipitation in hard water wastewaters has been supported for trickling filters as well as activated sludge. (Lowry-Texas) W72-10417

## WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

#### Ultimate Disposal of Wastes-Group 5E

MEASUREMENT OF TOTAL SOLIDS IN KRAFT BLACK LIQUORS, Kimberly-Clark Corp., Neenah, Wis. For primary bibliographic entry see Field 05G.

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North Carolina State Univ., Raleigh. For primary bibliographic entry see Field 05G.

ECONOMICS DICTATES FRESH LOOK AT AN ENGINEERING PROBLEM, Teale (J.M.) Associates, Woodcliff Lake, N.J. For primary bibliographic entry see Field 05E. W72-10421

## 5E. Ultimate Disposal of Wastes

SAN MATEO CONSTRUCTS OUTFALL INTO

SAN FRANCISCO BAY, San Mateo City Dept. of Engineering, Calif. For primary bibliographic entry see Field 05D. W72-09839

MARKETING CONVERTED POULTRY

MANURE, Pennsylvania State Univ., University Park. Dept. of Animal Industries. H. C. Jordan.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 197-198.

Descriptors: \*Farm wastes, \*Fertilizers, \*Nutrients, \*Poultry, Market value, Byproducts, Odor, Nitrogen. Identifiers: \*Compost, Soil conditioner.

Surveys were sent to firms engaged in processing and marketing poultry manure as a fertilizer or or-ganic soil conditioner. The needs for a marketable product are: (1) Total anaerobic microbe count must be reduced through drying to control odor; (2) Odor must be reduced to nil and then may be mashed with a plesant odor for lawn and garden trades; (3) Nitrogen in the form of urea and uric acid must be stabilized so that it is not released quickly and does not burn plants for lawn and garden sale; (4) The product must flow through a garden sale; (4) I ne product must how knough a lawn spreader and be easy to handle for lawn and garden trade; (5) The product must be stored in bags without picking up water and giving off odor for lawn and garden market; (6) Advertising and sale must be done without 'poultry manure' in the name of the product because of consumer or buyer existence with the exceptible executions of industriance. resistance, with the possible exceptions of industrial sales and naming an organic product 'composted poultry manure'. One may need to guard against negative advertising of odors, diseases, burning plants, and drawing flies. (See also W72-09940) (Schmitt-Iowa State) W72-09995

DISPOSAL OF BEEF MANURE BY DEEP PLOWING, Texas A and M Univ., College Station. Dept. of

Agricultural Engineering.
D. L. Reddell, W. H. Johnson, P. J. Lyerly, and P.

In: Livestock Waste Management and Pollution abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 235-238. 4 fig, 4 tab, 6 ref.

Descriptors: \*Farm wastes, \*Deep tillage, \*Cost comparisons, Cattle, Crop production, Crop response, Trenches, Waste disposal.

Four tillage techniques for deep plowing large quantities of manure into the soil were evaluated at El Paso and Pecos, Texas, during the summer of 1970. The soil at El Paso is a sandy loam, with a

sandy subsoil. The soil at Pecos is a silty clay loam. Up to 900 tons of manure per acre can be plowed under with a 30-inch moldboard plow at a minimum cost of 4.5 cents per ton. In sandy soils, the disk plow should be able to plow under at least the disk plow should be able to plow under at least 600 tons per acre with a minimum cost of 2.1 cents per ton. The 18-inch plow is limited to about 300 tons per acre. The trencher seems most versatile from the standpoint of high rates and soil penetration depths. The costs will be high and in the order of 50 cents per ton at the 900 ton level. The complete mixing of manure and soil as done by the trencher is impressive. At this time, the water quality program shows no serious pollution problem for surface water runoff. The soil water samples at the 4-foot depth indicate that denitrifi-cation is taking place. The major groundwater and soil pollution problem would appear to be from sodium chloride. (See also W72-09940) (Schmitt-lows State) W72-10006

DISCUSSION OF DISPOSAL OF SLUDGE AT WATER PURIFICATION AND SOFTENING WORKS OF THE MAHONING VALLEY SANI-TARY DISTRICTS, Ohio Dept. of Health, Columbus.

For primary bibliographic entry see Field 05F. W72-10131

DISPOSAL OF SLUDGE AT WATER PURIFICA-TION AND SOFTENING WORKS OF THE MAHONING VALLEY SANITARY DISTRICT, Mahoning Valley Sanitary District, Youngstown,

For primary bibliographic entry see Field 05F.

BRINE DISPOSAL FROM SODIUM ZEOLITE SOFTENERS, For primary bibliographic entry see Field 05F. W72-10134

DISPOSAL OF WASHWATER FROM PURIFI-CATION PLANTS, For primary bibliographic entry see Field 05F. W72-10140

LIME RECOVERY FROM WATER SOFTENING

SLUDGES, Minneapolis Water Dept., Minn. For primary bibliographic entry see Field 05F. W72-10142

RESULTS OF A DEMONSTRATION AND OTHER STUDIES OF THE DISPOSAL OF HIGH LEVEL SOLIDIFIED, RADIOACTIVE WASTES LEVEL SULIDIFIED, RADIOACTIVE WAS: IN A SALT MINE, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05D. W72-10399

BARGING INDUSTRIAL LIQUID WASTES TO

Du Pont de Nemours (E. I.) and Co., Edge Moor, S. W. Fader.

Journal Water Pollution Control Federation, Vol 44, No 2, February 1972, p 314-318. 5 fig.

Descriptors: \*Pigments, \*Industrial wastes, \*Oceans, \*Ultimate disposal, Barges, Liquid wastes, Automatic control, Mathematical models, Dispersion, Mixing, Waste dilution, Temperature, Thermocline, Design criteria, Capital costs, Operating costs, Cost analysis, Sampling, Bioassay, Waste disposal.

Industrial wastes from the manufacture of titanium dioxide pigment are transported to sea in a fully automated barge operated by remote control from a tugboat. The barge has a capacity of 1 million gallons, and the automatic control occupies a volume of less than 20 ft3, making it easily trans-ferable from one boat to another. The storage compartment arrangement allows the barge to be discharged entirely by gravity, so that loading at dockside is the only operation not fully automated. Capital costs were \$2.1 million, and operation costs average \$2.50/1000 gal or \$0.50 per ton for the 200 mile round trip. Results of continual monitoring have revealed no change in oceanwater multitude recognition of water materials in the community of the community of the community of water materials in the community of water materials. toring have revealed no change in occanwater quality or accumulation of waste materials in the disposal area. Biological surveys have also shown no conclusive indications of changes in the marine life of the water column attributable to the disposal operation. (Lowry-Texas) W72-10406

USE OF IRRADIATION IN PLASTICS WASTES

USE OF IRRADIATION IN PLASTICS WAS LO DISPOSAL, Wayne State Univ., Detroit, Mich. M. Tanaka, and T. Mifune. Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 98, No. SA 3, June 1972, p 561-567, 6 fig, 8 ref.

Descriptors: \*Plastics, \*Waste disposal, \*Irradia-Descriptors: Prastics, waste disposal, "Irradia-tion, "Mechanical properties, Gamma rays, Duc-tility, Tensile strength, Compressibility, Compac-tion, Solid wastes, Technical feasibility, Public health, Safety, Incineration, Landfills. Identifiers: "Packaging materials, "Resilience.

Recent projections have been assembled indicating that the plastics content of municipal solid wastes may be up to 30% in some cities by 1980. Problems in plastics wastes disposal include their damaging effects on incineration units and their resistance to compaction by mechanical means. A 2 Mev Van de Graaff accelerator was used to irradiate selected plastics samples to determine the feasibility of irradiation for making the plastics brittle enough to be easily consolidated by mechanical means. Laboratory investigations demonstrated that several sources of beta and gamma rays could be used without public health problems outside a plant area provided with the proper shieldings. However, dosage for the irradiation treatment of 1 gram of polyvinylchloride was established at 1000 curies (Sr89) applied for the company of the about 17 minutes (assuming 100% efficiency). Since the 1000 curies radiation source is rather large from the standpoint of operational safety, irradiation of plastic wastes for mechanical con-solidation was considered impractical for domestic refuse disposal purposes. However, the treatment has some specialized areas of potential usage, such as disposal of extremely toxic hospital wastes. (Lowry-Texas) W72-10418

ECONOMICS DICTATES FRESH LOOK AT AN

ENGINEERING PROBLEM,
Teale (J.M.) Associates, Woodcliff Lake, N.J.

J. M. Teale. Water and Wastes Engineering, Vol. 9, No. 3, p B-4-B-6-B-14, 1972. 5 tab, 1 ref.

Descriptors: \*Waste disposal, \*Economic feasi-bility, Annual costs, Marginal costs, Engineering, Industrial wastes.

As the experience of one vitamin manufacturer suggests, waste disposal is influenced by both engineering and economic considerations. Engineergineering and economic considerations. Engineering dictated the methods by which the firm could dispose of its liquid waste stream containing 25% methanol. The engineering solutions proposed were (1) fractional distillation to recover a product suitable for reuse; (2) fractional distillation to recover a product of purity higher than 55% for resale; (3) fractional distillation and burning in an industrial incinerator; (4) fractional distillation to reduce the cost of shipping out of the plant; (5) shipping it out of the plant without any prior treatment. The choice between these alternatives was made by appealing to economics. The net cost of made by appealing to economics. The net cost of each proposal was computed on an actual cost

## Group 5E-Ultimate Disposal of Wastes

basis and an incremental cost basis. The reuse alternative showed a profit under both cost bases and was, thus, ranked first among the five proposals. The sell alternative showed a profit with incremental costing and a loss with actual costing, and ranked second under both bases. The burn, distill, and trucking alternatives were ranked fifth, fourth, and third, respectively, under actual costing and fourth, third, and fifth, respectively, under incremental costing. (Settle-Wisconsin)

## 5F. Water Treatment and **Quality Alteration**

APPARATUS FOR DETECTING THE HARD-NESS LEVEL OF WATER, Erie Manufacturing Co., Milwaukee, Wis. (As-For primary bibliographic entry see Field 05A. W72-09801

METHOD OF TREATING WATER.

J. O. McLean.

U. S. Patent No. 3,649,532, 3 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 2, p. 723, March 14, 1972.

Descriptors: \*Patents, \*Water treatment, Water quality, \*Aeration, \*Oxygenation, \*Filtration, Water purification, Wells, Groundwater, Iron, Neutralization, Water quality, \*Domestic water.

A one tank system is provided for treating water from wells by the combined use of aeration, neutralization, oxidation and filtration. (Sinha OEIS)

METHOD AND ARRANGEMENT FOR PURIFY-ING WATER DRAWN FROM A GROUND-

U. S. Patent No. 3,649,533, 2 p, 2 fig, 2 ref; Offi-Gazette of the United States Patent Office, Vol. 896, No. 2, p. 723, March 14, 1972.

Descriptors: \*Patents, \*Water purification, \*Groundwater, \*Wells, Deep wells, Oxygen, Filtration, Iron oxides, \*Water treatment.

An improved method is provided for removing iron drawn from the ground water carrying soil layer in a ground water deep well. Oxygen or an oxygen-releasing substance is added to the water removed from the well. The water containing the oxygen is recirculated into the ground water carrying soil layer in at least one location spaced laterally a sufficient distance from the well to permit filtering of the iron precipitates. (Sinha-OEIS)

OBSERVATIONS ON BACTERICIDAL PRO-OBSERVATIONS ON BACLERICIDAL FR PERTIES OF DIGESTED SEWAGE SLUDGE, Illinois Univ., Urbana. Dept. of Agronomy. For primary bibliographic entry see Field 05C.

PROPOSED WATER TREATMENT FACILITIES FOR FOSS RESERVOIR, OKLAHOMA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Department of Housing and Urban Development, Fort Worth, Tex. Region VI.

Available from the National Technical Information Service as PB-204 460D, \$3.00 in paper copy, \$0.95 in microfiche. November 22, 1971. 33 p, 1 map, 8 tab.

Descriptors: \*River basin development. \*Environmental effects, "Water treatment, "Water supply, "Water supply development, Water utilization, Treatment facilities, Water demand, Water

resources, Water resources development, Reservoirs, Reservoir yield, Reservoir storage, Water distribution (Applied), Water management (Applied), Water sources, Project benefits, Project purposes, Demineralization, Desalination, Waste water disposal, Water quality, Water require-ments, Oklahoma.

Identifiers: \*Environmental impact statements, Washita River (Okla).

This project calls for the construction of a water treatment plant at Foss Reservoir, Oklahoma. The project will provide an assured source of good quality water to nearby cities, will improve w quality in the reservoir, and will increase the flow in the Washita River with resulting benefits to fish and waterfowl habitats and additional irrigation water. The plant may cause an increase of dissolved solids in the Washita River downstream from the reservoir. No other adverse environmental effects are noted. Alternatives considered include water transmission pipelines, dams, and drilling water wells. The most feasible alternative is drilling water wells, but it would be less economical than the treatment plant. The project will provide long-term and short-term benefits by utilizing the reservoir and restoring quality to the water therein. Since water is a renewable resource, the only irreversible commitment of resources would be the physical plant facility, the land and funds invested in it. Included is a Water Quality Investigation of the Foss-Division, Washita River Basin Project. (Brackins-Florida)

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT. For primary bibliographic entry see Field 06E. W72-09917

RIVER BASIN QUALITY SIMULATION. Texas Water Development Board, Austin. For primary bibliographic entry see Field 06A. W72-10109

DISCUSSION OF DISPOSAL OF SLUDGE AT WATER PURIFICATION AND SOFTENING WORKS OF THE MAHONING VALLEY SANI-TARY DISTRICTS

Ohio Dept. of Health, Columbus. T. R. Lathrop.

Journal American Water Works Association, Vol 25, No 11, p1530-1533, November 1933.

Descriptors: \*Ultimate disposal, Water softening, Sludge, \*Sludge disposal, \*Water treatment, Demineralization, Ultimate disposal, Agriculture. Identifiers: Vacuum filtration.

A serious problem of handling softening sludge developed with continuous sludge removal, low river flows, and complaints due to creek discoloration. Softening sludge at Oberlin, Ohio, had a specific gravity of 1.13-1.17, 72-85% water content, and density of 70.5-73 pounds/ft.3. The Columbus, Ohio plant received complaints after waste discharges were noticed in the Scioto River. Sludge discharge at Newark, Ohio, created sludge blankets in the river. Sludge was pumped to an abondoned quarry and borrow pit in Marion, Ohio. An experimental vacuum filter reduced moisture content to 50%. The sludge has value equal to agricultural lime for soil neutralization. In Fostoria, Ohio, sludge is settled in tanks and discharged to low ground. In Miami, Florida, a 1 to 2 inch covering was excellent for growing grass and vegetables on account of its quality of holding moisture. The Sandusky, Ohio, facility settles and decants their waste. The major problem is ultimate disposal of solid wastes. (Nardozzi-AWWARF)

DISPOSAL OF SLUDGE AT WATER PURIFICA-TION AND SOFTENING WORKS OF THE MAHONING VALLEY SANITARY DISTRICT, Mahoning Valley Sanitary District, Youngstown, W. H. Dittoe.

Journal American Water Works Association, Vol 25, No 11 p1523-1530, November 1933. 3 tab.

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Descriptors: \*Water purification, \*Water soften-ing, Costs, Water treatment, Sludge, Sludge disposal, Settling basins, \*Ponds. Identifiers: Decantation, Sludge production, Sludge volume, Sludge utilization

The elements entering into the design and operation of sludge holding ponds are discussed. The 40mgd treatment facility employs purification and lime-soda ash softening with filtration. Lime, soda-ash, and alum are mixed with raw water. The precipitates settle and the process water is carbonated. There is sludge recirculation prior to fil-tration and continuous sludge removal. Sedimentation tank sludge is settled in two ponds, each holding one year's sludge production. Waste supernatant will overflow to the river, evaporate, and seep into the ground. Tabulations are presented for sludge produced in treatment and the volume and percentage of water in one ton of sludge. Sludge is pumped 1300 feet in 4-inch line to the ponds. Detion equipment is provided in each pond. A pond supernatant less than 15ppm turbidity is disposed in a creek. Solids removed may be used in soil treatment. The ultimate success of disposal depends on how effectively sludge utilization can be promoted. (Nardozzi-AWWARF)

WINFIELD WINS A NEW WATER SUPPLY, Black and Veatch, Kansas City, Mo.

W. D. Skinner. Willing Water, Vol 16, No 3, p8-9, March 1972. 2

Descriptors: \*Water purification, \*Lagoons, Transmission lines, Costs, Kansas, \*Water treatment, \*Impoundments, Saline water intrusion, Settling basins, Ponds. Identifiers: \*Washwater reclamation, Winfield (Kansas)

A \$3.6 million water improvement program is outlined including surface water impoundment, water treatment plant, raw and finished water transmission mains, and elevated storage tanks. Winfield utilized well supplies until improper brine disposal methods from oil wells caused salt-water intrusion into the aquifers. The development of an impounded alternative provided the best quality raw water for supply and recreation. City, Department of Housing and Urban Development, and Soil Conservation Service costs are tabulated. Raw water flows by gravity from the reservoir to a conventional clarification plant with solid contact basins and dual media filters. Pre-sedimentation basins, secondary mixing basins, clearwell, treated water storage reservoir, washwater reclamation basin, and two sludge lagoons are included. Flexible treatment operation is planned to cope with taste and odor problems. Filter washwater is reclaimed in a 72,000-gallon basin. Basin sludge is lagooned or settled in ponds. New distribution lines are tied to existing water mains. (Nardozzi-

BRINE DISPOSAL FROM SODIUM ZEOLITE SOFTENERS,

Journal American Water Works Association, Vol 39, No 25, p1215-1219, December 1947. 2 fig, 5 ref.

Descriptors: \*Brine disposal, Costs, \*Zeolites, Ion exchange, \*Water treatment, \*Water softening, Dilution, Evaporation, Ponds.

The waste from sodium zeolite softeners contains waste products of regeneration plus unused salt. The brine is principally composed of chlorides of calcium and magnesium, together with small amounts of various iron and manganese compounds. Usually 5-10% of the treated water is needed for regeneration. Salt requirements are 0.4-0.5 pounds/1000 grains hardness removed. Limiting USPHS potable water standards are: magnesium <125ppm; chloride<250ppm; and total solidation of the control of the control

A STUDY OF SLUDGE AT WATER PURIFICA-TION PLANTS IN NEW ENGLAND, Cambridge Water Dept., Mass.

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Journal New England Water Works Association, Vol 62, No 4, p265-274, December 1948. 13 ref.

Descriptors: \*Sludge treatment, Water purification, Sewage disposal, Water treatment, \*Sludge disposal, \*Sludge treatment, Dilution. Identifiers: Basin cleaning.

Sludge production and disposal procedures for iron salt, mud, coarse suspended solids, color, bacteria, and microscopic organisms are discussed. Sludge production and accumulation is influenced by raw water character, coagulation efficiency, and basin performance. General basin cleaning procedure is to dewater the tank and pump out the sludge. Mechanical and daily sludge removal procedures allow continuous operation; eliminate duplicate units and reduce number and size of basins; increase efficiency; lower operation, maintenance, and initial costs; prevent sludge decomposition in basins; and are more flexible for design and operation. Sludge disposal methods included release with domestic sewage, discharge to rivers, streams reservoirs, lakes, or ponds, and lagoons. In discharge to watercourses, dilution, sludge blanketing, and silting must be considered. Waste transported to a sewage treatment plant must be examined in relation to sewer system damage, amenability to existing treatment process, hydraulic and biological plant interferences, and effect on final plant effluent. Final solids removal is suggested by recovering humic acids and humates or by landfill. The best method appeared to be mixing with domestic sewage. (Nardozzi-AWAARF)

## RECOVERY OF WATERWORKS SLUDGE,

Journal of the Institution of Water Engineers, Vol 12, No 3, p211-212, May 1958.

Descriptors: Colloids, Water treatment, Sludge treatment, Sludge digestion. Identifiers: \*Alum recovery, Alum sludge.

Trivalent metallic ions such as Al+3 and Fe+3 neutralize negatively charged colloids causing particles to coalesce. The dumping of alum sludge on land makes it worthless for agricultural purposes. Fundamental research is aimed at studying the sludge nature and the way the coagulant is found to coagulated water. The method of investigation includes: study of nature and quantity of sludge produced in water treatment plants; treatment of

wet sludge obtained by biological methods such as aerobic digestion and anaerobic digestion followed by aerobic digestion; and chemical treatment of oxidation followed by extraction with acid. Planned laboratory testing to aid in the control of digestion and alum recovery are; fixed and volatile solids analyses on raw sludge and digestor samples; pH; A12 O3 determination by gravimetric method following acidification and paper filtration of sludge; and spectrophotometric analysis of iron. Preliminary tests show anaerobic digestion of alum sludge improves alum recovery operations. (See also W72-10137) (Nardozzi-AWWARF) W72-10137) (Nardozzi-AWWARF)

## RECOVERY OF WATERWORKS SLUDGE - II,

Journal of the Institution of Water Engineers, Vol 12, No 7, p491-492, November 1958.

Descriptors: \*Digestion, Anaerobic conditions, Aeration, Water purification, Water treatment, Sludge disposal, Sludge treatment, Sludge digestion.

Identifiers: \*Alum recovery, Aluminum hydroxide.

Water purification sludge can either be dewatered, dried, and disposed of cheaply or the coagulant can be reclaimed for reuse with final disposition of the sludge commercially if a market can be found. Raw sludge at the Thockley Filtration Plant is slightly alkaline and odorous following the establishment of anaerobic conditions in lagoons. The sludge contains organic matter, humic acid, aluminum hydroxide (40% Al203), and ferric hydroxide (4% Fe203). Digestion was studied using 2-liter batch samples of raw sludge and 2-liter batch samples of raw sludge. The digested sludge is treated with H2SO4 with the mixture filtered through paper. Recovered alum data are tabulated. Laboratory work showed anaerobic digestion of alum sludge improved alum recovery. A potentially applicable solution is the aeration of the sludge in the presence of certain bacteria species. (See also W72-10136) (Nardozzi-AWWARF)

# PROBLEMS IN DISPOSAL OF SLUDGE AND WASHWATER FOR CONNECTICUT WATER FILTRATION PLANTS, Connecticut Dept. of Health, Hartford.

Connecticut Dept. of Health, Hartford. F. O. A. Almquist.

Journal New England Water Works Association, Vol 60, No 4, p344-358, December 1946. 1 fig, 2

Descriptors: \*Lagoons, \*Waste dilution, Water purification, \*Water treatment, Sludge disposal, Connecticut, Waste dilution, \*Settling basins. Identifiers: \*Filter washwater.

Data are reviewed from sludge analysis at purification facilities, and discussed plant problems and possible remedies to control filter washwater and sedimentation basin sludge discharges. Physical and chemical sludge data are tabulated and bacteriological tests reported. Six treatment plants using alum coagulants found different sludge handling solutions. Three plants lagooned this waste and decanted the supernatant. Sludge drying beds with 4 inch underdrains topped by graded gravel and sand dewatered filter washwater and basin sludge at one utility. One plant discharged washwater to a meadow while another plant transported its waste by pipe to a larger receiving stream for dilution. Eleven plants diluted their waste. A table of practice in cleaning basins showed cleanings/year, disposal methods, complaints, and remarks for 17 plants. Remedies are: discharge to a sewerage system, dilution in streams, sludge drying beds, further research, lagooning with decantation, and pumping to a reservoir or lake. (Nardozzi-AwWARF)

THE PITSFORD TREATMENT WORKS OF THE MID-NORTHAMPTONSHIRE WATER BOARD.

BOARD, Mid-Northamptonshire Water Board (England). J. W. Milne.

Journal of the Institution of Water Engineers, Vol 12, No 1, p83-105, February 1958. 14 fig, 1 tab, 3 appendices.

Descriptors: "Design data, "Water softening, Centrifugation, Costs, Pumping, "Water treatment, "Sludge treatment.
Identifiers: "Filter washwater, "Basin sludge, Sludge beds.

The treatment facilities for water softening an impounded water supply and the pumping considerations are discussed. The treatment site was chosen for uniformity in slope, optimization of pumping operation, and placement from sludge treatment units. Design and construction details are provided for general arrangement of plant and buildings; raw water pump house; chemical block reaction tanks; filters with automatic controllers; filtered watertank; main pump house and auxiliary engine house; chemical haiding; chemical mixing and feeding; sterilization and stabilization; output control; and washwater and sludge disposal. Two 93,500 gallon settling tanks are provided for filter washwater. Lime-soda softening sludge from the concentrator and washwater settling tanks are pumped to a centrifuge. The centrifuge can handle a 10% sludge at 2500 gallons/hour and produce a 40-50% cake by weight for landfill. An emergency sludge bed is provided in case of electrical failure to the centrifuge, conveyor, or shear pin of centrifuge gear unit. Information is provided on electricity supply and instruments, structural and building details, and operating experience. Appeadixes are shown for composition of main control and instrument panel; motors required in plant operation; and main contracts awarded. (Nardozzi-AWWARF)

DISPOSAL OF WASHWATER FROM PURIFI-CATION PLANTS,

Journal American Water Works Association, Vol 39, No 12, p1219-1223, December 1947. 2 ref.

Descriptors: \*Sludge treatment, Sewers, Lagoons, Legal aspects, \*Water treatment, Maryland, \*Sludge disposal, Waste identification. Identifiers: Washwater, Pre-chlorination, Laurel

Waste character, quantity, effects, disposal methods, and legal difficulties are outlined for water treatment sludges. Washwater turbidities of 2000ppm have declined to 50-100ppm during backwash. A 1-hour detention period can lower turbidity to 40-50ppm. Pre-chlorinated supernatant is practically free of coliform organisms. Methods to effectively determine BOD are not included in Standard Methods. Each plant individually must determine waste quantity based on sludge character. Wastes contain silt and chemicals. Discharge to streams can cause discoloration, but public health is not jeopardized. Odors can emanate from stored sludge. Disposal methods include: discharge of washwater and sludge wastes to stream or returned to the plant inlet; washwater and sludge with supernatant discharged to stream or returned to the plant inlet; mashwater and sludge to sewers; and pumping to a reservoir. Experiments were conducted on settling filter washwater and basin sludge. The City of Laurel, Maryland, enjoined suit on an upstream facility discharging waste to the river, charging quality degradation due to sludge disposal. The need for further definition of pollution effects, health hazard, and pre-chlorination of washwater to decrease bacterial content was established. (Nardozzi-AWWARF)

## Group 5F-Water Treatment and Quality Alteration

TOKYO'S ASAKA PURIFICATION PLANT,

Tone River Waterworks Construction Center, Tokyo (Japan). H. Fujita.

Water and Sewage Works, Vol 14, No 3, p73-82, March 1967. 12 fig, 1 tab, 7 photos.

Descriptors: \*Water purification, Design data, Construction, \*Water treatment, \*Sludge treat-ment, Sludge disposal, Filtration. Identifiers: \*Alum recovery, \*Washwater identifiers: \*Álum recovery, recovery, Asaka (Japan).

Design and construction data are outlined for a Design and construction data are outlined for a \$73.5 million purification plant treating a raw water with normal turbidity, 10-50 ppm; COD, 1 ppm; and manganese, 0.1-0.3 ppm. Features in-clude: space-saving layout and structure; unique sedimentation basins; deep-well underground buildings; huge pump installations; and supervisory control system. Details are provided on the raw water intake and conveying facility; receiving well and sedimentation basins; rapid sand filters; administration house and clear water pumping station; clear water reservoirs; chemical plant; power supply installation; and washwater and sedimentation basin sludge disposal system. Washwater is settled in 1.2 million gallon basin and returned to the receiving well by wash-waste pumps to recover 26-53 mgd of water. Sedimentation of sludge is concentrated and dewatered in the plant. Sulfuric acid is added to the sludge. Alum is recovered for reuse. Thickened inert material is vacuum filtered with the cake used for landfill. (Nardozzi-AWWARF)

LIME RECOVERY FROM WATER SOFTENING

SLUDGES, Minneapolis Water Dept., Minn.

H. H. Sowden.

Journal American Water Works Association, Vol 33, No 4, p741-748, April 1941. 2 fig, 3 tab.

Descriptors: \*Sludge treatment, Costs, \*Water softening, \*Lime, Filtration, Sludge, Coagulation, Sludge disposal, \*Water treatment, \*Demineralization. Identifiers: \*Calcining, Thickening, Muffle furnace. Vacuum

Experimental calcining of softening sludge to produce a reuseable lime product and a method to determine percent solids in the sludge are discussed. Turbid matter is removed by alum coagulation in separate basins before softening. Coagulant aids interfered with vacuum filtration dewatering. Filtration rates of 2010 pounds/sq ft/24 hr were achieved on unconditioned precipitator sludge. A 5% CaO solution increased dewatering while powdered coal, carbon dioxide, bentonite, and heat treatment were not effective. Savings are realized in the purchase of new lime and sludge disposal costs. Tabulations of lime analyses are presented for calcination experiments. A 2-5% solids softening sludge from the precipitators is thickened by natural subsidence and mechanical means to 20-30% solids. An experimental vacuum filter concentrates solids to 60%. Air drying reduces moisture content to 10%. Sludge is calcined in a muffle furnace at 2000 deg F till completely burned. A formula, based on weight and volumetric considerations, is derived to determine percent sludge solids. Excess lime should be recovered. Economic feasibility depends on: new lime cost; calcining expenditures; and sludge disposal criteria. (Nardozzi-AW-WARF) W72-10142

CONCLUSIONS AND RECOMMENDATIONS OF THE W. H. O. EXPERT COMMITTEE ON COMMUNITY WATER SUPPLY. GENEVA-

American Univ., Beirut (Lebanon). School of

Environ Health, Vol. 12, No 2, p 160-163, 1970.

Identifiers: \*Conclusions, Geneva, Switzerland, \*WHO Expert Committee on Community Water Supply, \*Municipal water, \*Water supply.

This was the first Expert Committee to be convened by WHO specifically to consider problems of community water supply. Its composition reflected teaching, training and research in en-vironmental sanitation, medicine, public health administration, health surveillance, economics, and engineering. Specific recommendations were made for national and international action to achieve a significant improvement in community water supply programs.--Copyright 1972, Biological Abstracts, Inc. W72-10208

ORGANIC SORPTION FROM AQUEOUS SOLU-TION BY TWO CLAYS,

Mellon Inst., Pittsburgh, Pa. M-D Luh, and R. A. Baker. Proceedings, Industrial Waste Conference, 25th, May 5-7, 1970, p 534-542. 2 fig, 3 tab, 11 ref.

\*Clays, Descriptors: \*Adsorption, \*Clays, \*Electrochemistry, Kaolinite, Montmorillonite, Phenol, Anions, Cations, Biodegradation, Centrifugation, Filtration, Hydrogen ion concentration, Colorimetry, Water treatment.

Since small clay particles possessed of high electronegative charge often carry over into the treated water in water treatment plants, the question of whether or not some organic com-pounds are attached to the particles is of considerable significance to the treated water quality. The extents of sorption of phenol, m-cresol, 2,4 dichlorophenol, m-amino phenol, 2,4 diamino phenol hydrochloride, and sodium salts of valeric and n-hexanoic acids onto sodium montmorillonite and sodium kaolinite were monitored as a function of time by analyzing the liquid phase for the organic chemical. Results indicated that only m-amino phenol and 2,4 diamino phenol exhibited positive sorption and then only over the acidic pH range. At pH 2, both are strongly sorbed by both homoionic clays. Addition of amino groups which increases basicity of substituted phenolic com-pounds increases sorption potential, with sorption being attributed to the charge attraction forces between negatively charged clay surface and posi-tively charged organic ions. Unionized molecules and organic anions were either not sorbed or were very weakly sorbed because of competitive sorption of the more polar water molecule and repulsive force between the organic anions and clay surface. (llowry-Texas) W72-10211

STANDARD FOR DISINFECTING WATER MAINS.
American Water Works Association, New York.

Journal of the American Water Works Associa-tion, Vol 60, No 9, p 1087-1093, September 1968. 3 tab, append. AWWA C601-68.

Descriptors: \*Disinfection, \*Chlorination, \*Standards, Conduits, Water quality control, Testing procedures, Chlorine, Coliforms, Water distribution (Applied). Identifiers: Hypochlorites.

Basic procedure under this standard is to prevent contaminating materials from entering mains under construction of repair, to flush out those that do enter, to disinfect any residual contamination, and to test for bacteriologic quality after disinfection. New pipe must be kept clean and dry until installed. Unless the tablet method is used, the main shall be flushed prior to disinfection. Either liquid chlorine or hypochlorites may be ap-plied by continuous feed, by the slug method, or by the tablet method. After disinfection for ap-propriate periods, a final flushing must bring chlorine residual levels to those normally found in the system. Bacteriologic tests for coliform presence must be satisfactory before the water is

placed in service. The drop dilution method of approximating total residual chlorine is outlined in the appendix. (Weir-AWWARF) W72-10354

BACTERIOLOGY OF WATER PIPES.

Journal of the American Water Works Association, Vol 36, No 1, p 52-58, January 1945.

Descriptors: Bacteria, \*E. coli, \*Thiobacillus fer-rooxidans, \*Slimes, Taste, Odor, Color, Turbidi-ty, Impaired water quality, Water distribution (Aped). Incrustation. plied), incrustation. Identifiers: \*Bacteriology, Incrusting colonies

The kinds and numbers of bacteria which exist in a given situation depends on the environment. Water distribution systems afford constantly changing environments, and as a consequence bacterial forms differ from place to place and from season to season. Most of the bacteria which inhabit water pipes are attached forms which build encrusting colonies or slimes over the walls of the pipe. The types usually encountered are Crenothrix, Beggiatoa, and Thiobacillus thioox-idans. These bacteria affect the odor, taste, color, and turbidity of water. They may cause pipe corro-sion with the production of tubercules, and may also give rise to 'red water'. (Britton-AWWARF) W72-10356

MAINTENANCE OF CHLORINE RESIDUAL IN THE DISTRIBUTION SYSTEM, Houston Water Dept., Tex.

C. R. Harvill, J. H. Morgan, M. C. Hagar, and A.

Journal of the American Water Works Association, Vol 32, No 12, p 1797-1806, December 1942.

Descriptors: \*Fouling, \*Chlorination, Organic matter, Corrosion, Ammonia, Bacteria, matter, Corrosion, Ammonia, Bacteria, Coliforms, Chlorine, Water distribution (Applied), Taste, Odor, Impaired water quality, Disinfection, Water pollution treatment, Distribution systems. Identifiers: \*Chloramine, Crenoforms, Houston (Tex), Boonville (Mo), Bio-fouling, Wheeling (W.

Chlorine or chloramine residuals must be maintained at appropriate levels throughout the distribution system to keep bacteria to a minimum. Chlorine is used to control the crenoform in storage reservoirs and ammonia is used in an 'ammonia-induced breakpoint chlorination' to regulate chlorine odors and tastes. A high bacterial count in dead ends of the distribution system can be brought down by maintaining sufficient chloramine residuals. Prechlorination, filtering, then post-chlorination proved satisfactory to maintain the chlorine residual necessary for growth control. A routine sampling program is necessary. One to two ppm is a desirable and ef-fective chlorine residual. (Weir-AWWARF) W72-10357

SOIL BACTERIA AND COLOR PROBLEM IN DISTRIBUTION SYSTEM

Wilmington Water Dept., Del. H. T. Victoreen.

Journal of the American Water Works Associa-tion, Vol 61, No 9, p429-431, September 1969. 2 fig, 10 ref.

Descriptors: \*Soil bacteria, \*Water quality, Color reactions, Quality control, Distribution systems, Turbidity Identifiers: Nutrient-limited bacterial growth.

The presence of the genus Arthrobacter and its close relatives in the distribution system is responsible for the accumulation of discolored water deposits. Tests show that this type of bacteria can live in a limited nutrient environment. Growth rate increases with increasing flows and temperatures and in areas of high dechlorination. The prime

#### WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

## Water Treatment and Quality Alteration—Group 5F

food source is not known. Ferrous iron strongly stimulates one type of Arthrobacter, but has not been shown to be the energy source. (Britton-AW-W72-10358

AUTOMATION OF WATER ANALYSIS AND ANALYTICAL PROCESS INSTRUMENTATION, Foxboro Co., Mass. For primary bibliographic entry see Field 05A. W72-10359

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y for PLASTIC PIPE AND WATER QUALITY, National Sanitation Foundation, Ann Arbor, Mich

C. A. Farish. Journal of the American Water Works Associa-tion, Vol 61, No 9, p 480-482, September 1969.

Descriptors: \*Plastic pipes, \*Water quality, Pota-ble water, Materials, Water works, Taste, Odor, Public health, Safety, Pressure, Quality control,

Standards, Toxicity.

Identifiers: Polyethylene, Polyvinyl chloride (PVC), Acrylonitrile-butadiene-styrene (ABS), Applications, Public health standards, Physical standards, National Sanitation Foundation, Certification, ISO equation.

Plastic pipe, supported by research and testing as to its safety, will not adversely affect the quality of potable water. In 1968, pipe and fittings used in potable water applications were primarily produced from three basic materials: polyethylene; polyvinyl chloride (PVC); and acrylonitrile-butadiene-styrene (ABS). New materials are being developed for both cold and hot water applications. The water works industry should insist that these materials meet public hot water applications. The water works industry should insist that these materials meet public health standards, and sound engineering and physical standards before they are used in potable water systems. Unacceptable plastic materials may permit extraction of a variety of chemical elements that could be toxic or create taste and odor problems. National Sanitation Foundation provides unbiased certification of those plastics which do not adversely affect water quality. Its Standard No. 14 sets forth the requirements and conditions to protect the public's health and safety concerning the use of plastics in potable water applications. The pressure ratings of the NSF-listed plications. The pressure ratings of the NSF-listed pipe are calculated by the use of the ISO equation. (Andrews-AWWARF) W72-10360

COMPUTERIZED OPERATION OF DISTRIBU-TION SYSTEMS, San Antonio City Water Board, Tex.

San Antonio V. R. P. Van Dyke. Journal of the American Water Works Associa-tion, Vol 62, No 4, p 234-240, April 1970. 6 fig.

Descriptors: \*Instrumentation, \*Remote control, Telemetry, Analytical techniques, Data collections, Monitoring, Control systems, Automatic control, Electronic equipment, Computers, Distribution systems tribution systems.

Identifiers: San Antonio (Tex).

When anticipating the installation of automatic remote control equipment in distribution systems, attention must be given to potential personnel problems arising from retraining, shifting or releasing workers, and salary changes, as well as to choice of a system appropriate to the needs of a particular water facility. In San Antonio, a process control computer permits a single operator to manage both the water distribution system and a manage both the water distribution system and a large heating and cooling facility. The computer monitors 128 points in the system with capacity to monitor double that many as expansion occurs. One typewriter records hourly logs; a second records alarm messages, off-normal readings. The pressure and level transmitting stations are packaged units. (Weir-AWWARF) W72-10361 LOSS IN CAPACITY OF WATER MAINS, Los Angeles Dept. of Water and Power, Calif. E. S. Mamrelli, L. Streicher, H. W. Tracy, J. W. Trahern, and F. O. Waters. Journal of the American Water Works Associa-tion, Vol 54, No 10, p 1293-1312, October 1962. 13

Descriptors: \*Corrosion control, \*Linings, Conduits, Corrosion, Coatings, Flow, Cleaning, Chlorination, Disinfection, Chemical reactions, Bacteria, Construction materials, Test procedures, Hazen-Williams equation. Identifiers: \*Tuberculation.

Loss in carrying capacity resuls from various causes. Biological growths can be controlled by using appropriate chlorine dosages. Silting may be removed by increasing velocity or scouring with stiff brushes. Incrustation occurs in hard waters at favorable temperatures and may be controlled by softening the water or lowering its pH content. Corrosion is the most common cause and may be kept to a minimum by avoiding direct coupling of dissimilar metals or by altering the physical, biological, and chemical properties of the water. Mechanical cleaning followed by cement-mortar lining is the most satisfactory method of rehalining is the most satisfactory method of rehabilitating water mains. The most economical new mains are of tar-coated metal, asbestos-cement and concrete, and factory cement-mortar-lined cast-iron and steel. Flow tests are required to determine C values (the C factor of the Hazen-Williams formula). (Weir-AWWARF)

EFFECT OF FLOW RATE ON CARBON FILTER PERFORMANCE, Montgomery (James M.) Consulting Engineers, Inc., Pasadena, Calif.

C. A. Rambow.

Journal of the American Water Works Association, Vol 55, No 8, p 1037-1043, August 1963. 6 fig, 4 ref.

Descriptors: \*Water treatment, \*Activated carbon, \*Insecticides, \*Flow rates, Filters, Adsorption, DDT. Identifiers: Carbon filters.

Tests were performed to determine the effects of adsorbate concentration and flow rate upon the adsorption of fluorescein and DDT from water by activated carbon. Fluorescein concentrations were activated carbon. Phorescent concentrations were measured photometrically, and DDT was deter-mined by labelling with C14. The percentage of ad-sorbate removed by the carbon increased as either the adsorbate concentration or the flow rate decreased. In terms of amount of adsorbate recovered per unit time, high flow rates are advantageous. For a given adsorbate concentration and flow rate, the percentage adsorbed decreases with time as the amount of adsorbate in the carbon filter increases. (Bean-AWWARF)

CONTROL OF FREE RESIDUAL CHLORINE BY AMMONIATION, Brantford Public Utilities Commission (Ontario).

D. B. Williams.

Journal of the American Water Works Associa-tion, Vol 55, No 9, p 1195-1205, Sept. 1963.

Descriptors: \*Water treatment, \*Chlorination, \*Ammonia, Odor, Hydrogen ion concentration, Monitoring.
Identifiers: \*Free residual chlorine, \*Chloramines,

Application of 0.15 ppm NH3 for each 1 mg/l of HOCL will theoretically disintegrate the HOCL. In practice this ratio has been found to be from 1 to 6.7 to 1 to 8.1. Excessive application must be avoided since it will convert the free residual to amines. This method is used for dechlorination at the Brantford Ontario Plant. This method is more easily accomplished on an operating basis than is dechlorination by sulfur dioxide. It should, however, be controlled by continuous monitoring of the chlorine residual by amperiometric-type residual recorders. Nitrogen trichloride, so troublesome in the Brantford plant and so closely guarded against by the use of sulfur and ammonia, is no longer a problem. This method only destroys free chlorine-not dichloramine or monochloramine-therefore it may not be used ex-cept after prechlorination application to produce free chlorine residuals. The pH and mineral characteristics have no effect on the reactions. (Bean-AWARF) (Bean-AWWARF) W72-10364

OPERATING EXPERIENCE WITH STEEL

TANKS, Marin Municipal Water District, Corte Madera,

W. R. Seeger.

Journal of the American Water Works Association, Vol 54, No 10, p 1221-1231, October 1962. 1 fig, 2 tab, 1 ref.

Descriptors: \*Steel structures, \*Maintenance, Structural design, Reservoir storage, Coatings, Spraying, Corrosion control, Construction materi-

Identifiers: Marin Municipal Water District

Steel tanks such as those used in the Marin Municipal Water District are earthquake-resistant and can be automatically welded in the field. Other improvements are safer spiral stairways for better access, a section of screening under the roof for ventilation, debris catchers, under gaging platforms, and steel pipe columns. Tank floor plates are protected by preparation of a uniformly oiled sand pad which can be treated again as necessary. Upper portions of the tanks' interior surface are subject to temperature changes and constant Upper portions of the tanks interior surface are subject to temperature changes and constant wetting and drying. Cold-applied coal-tar base solution has provided superior coating to hot-applied coal-tar enamel. A zinc chromate primer under two coats of a metal-protective finish provides excellent exterior protection. A nainting coats vides excellent exterior protection. A painting cost breakdown is given. (Weir-AWWARF) W72-10365

LEGAL ASPECTS OF CROSS CONNECTION INSPECTIONS, Washington Univ., Seattle. Bureau of Governmen-

tal Research and Services. E. H. Campbell.

Journal of the American Water Works Associa-tion, Vol 61, No 8, p 409-412, August 1969. 11 ref.

Descriptors: \*Legal aspects, Administrative decisions, Building codes, On-site investigations, Judicial decisions, Water pollution control, \*Inspection, Distribution systems.

Identifiers: Liability, Cross connections.

Liability for water contamination rests with the municipal utility. Cross-connections are the principal causes and routine inspections and adequate records of these inspections are essential in conrecords of these inspections are essential in con-trolling cross connections. Access for inspections is a problem. Recent legal interpretations are discussed. A successful cross-connection program must be tempered with good management and an awareness of the liability incurred by the mu-nicipal system. (Weir-AWWARF) W72-10366

REPLACEMENT OF WATER DISTRIBUTION

American Water Works Association, New York. Task Group 2850D.

Journal of the American Water Works Associa-tion, Vol 61, No 9, p417-422, September 1969. 1 tab, 44 ref, append.

Descriptors: \*Corrosion, \*Water qual ity, Costs, Hazen-Williams equation, Distribution systems,

## Group 5F-Water Treatment and Quality Alteration

Identifiers: Replacement, Capacity, Leakage, Service, Liability, Hazen-Williams friction coeffi-

Water distribution mains, if designed and constructed properly and protected against corrosion, will last indefinitely. Age alone does not determine the replacement criteria for water mains. The investigation is limited to the economical replacement of smaller cast-iro and asbestos-cement pipe. Objectionable conditions in a main, which are hard lentify and locate, generally are categorized in a discussion of: inadequate capacity, adverse effect on water quality, permissible leakage, and structural inadequacy. It is difficult to determine the liability of a water utility for damages caused by water escaping from water distribution mains. Conditions of mains could be monitored by periodic inspections for leakage or through a system of reporting repairs and their cost. In general, a main should be replaced whenever the annual cost of maintaining and repairing a distribution main exceeds the annual cost of a new main, or, where economical repairs cannot provide the required capacity, prevent the degradation of water quality, ensure the safety of persons and property, and ensure the continuity of service. (Andrews-AWWARF)

DISEASE DUE TO 'NONPATHOGENIC' BAC-

TERIA, South Tahoe Public Utility District, South Lake Tahoe, Calif.

R. L. Culp. Journal of the American Water Works Associa-tion, Vol 61, No 3, p 157, March 1969. 2 ref.

Descriptors: \*Bacteria, \*Impaired water quality, Soil bacteria, Water quality, Water distribution (Applied), Water quality control, Chlorination, Public health, Water pollution control, Pathogenic bacteria, E. coli, Pseudomonas, Human diseases. Identifiers: \*Gram-negative bacteria.

Gram-negative bacteria such as E. coli and P. aeruginosa can, under certain conditions, become pathogenic to man-especially to young infants and premature babies. The advent of sulfonamides and antibiotics has broadened the range of conditions within which these bacteria may act as pathogens. Water supplies can be made and kept free of all Gram-negative bacteria by chlorination of all water supplies, the covering of all finished water storage reservoirs, filtration of all surface waters, continuous monitoring and recording of chlorine residuals and turbidity in finished water, and elimination of cross connections to water distribu-tion systems. (Britton-AWWARF) W72-10368

EFFECT OF CALCIUM BICARBONATE ON DISINFECTION BY HALOGENS, Massachusetts Univ., Amherst. Dept. of Civil En-

L. W. Kuzminski, T. H. Feng, and C. C. Liu. Journal of the Sanitary Engineering Division, ASCE, Paper 8722, Vol 98, No SA1, p 229-2146, Feb. 1972. 1 fig, 2 tab, 12 ref.

Descriptors: \*Water treatment, Water quality, Public health, Bacteria, \*Disinfection, Halogens, \*Calcium carbonate, Inorganic compounds, Hydrogen ion concentration, Temperature.

Inorganic entities comprise a significant portion of chemicals in water and their effects upon the disin-fection process should be fully evaluated. This investigation was undertaken to determine possible effects of various inorganic chemical additives in water on the efficacy of disinfection by halogens. The chemical used was calcium bicarbonate. Halogen concentrations were on an equal alent weight basis. The test micro-organism was Escherichia coli. The exposure substrate was cold sterile distilled water to which appropriate quantities of calcium bicarbonate were added. All bacterial exposures to disinfectant were performed at pH values 5.0 and 7.0 and a temperature of 2-3C. Bacterial death kinetics are presented in comparisons of varying additive conditions for each halogen and also for constant additive conditions for all halogens used. A hampering effect of calcium on the disinfection efficacy of chlorine, bromine and iodine was found. (Bean-AWWARF) W72-10370

SILICATE AS FE, MN DEPOSITION PREVEN-TATIVE IN DISTRIBUTION SYSTEMS,

Ontario Water Resources Commission, Toronto. F. J. Dart, and P. D. Foley. Journal of the American Water Works Associa-tion, Vol 64, No 4, p 244-249, April 1972. 4 fig, 4

Descriptors: \*Water treatment, Public health, Sanitary engineering, \*Iron, \*Silicates, \*Distribu-tion systems, \*Corrosion, Chlorination, Man-ganese, Filtration, Anion exchange. ganese, Factorium silicate. Identifiers: \*Sodium silicate.

Application of sodium silicate with chlorination has become a useful standard procedure for the prevention of iron deposition in at least a dozen Ontario well-water systems. Although up to 1.3 mg/l iron have been treated with a maximum of un to 6.2 mg/l silica, no disadvantage of the technique so far has been demonstrated. In fact, evidence of side benefits, such as main cleaning and corrosion control, has been indicated. A simple filtration test is used to determine whether the metal ion sequestering in treated water has been successful. The method may also be applicable to other sequestering agents such as the polyphosphates. The removal of silicate-stabilized iron can be effected by the addition of a small amount of additional ferric ion and standard sand filtration. The iron-silicate complex also appears to be a strong negative ion, as judged by its adsorption by even a weak base anion-exchange resin. Possible rence of the iron-silicate couples in natural waters where standard filtration is effective in ion removal is suggested. Much work remains to be done with respect to manganese treatment. This could be developed in parallel with theiron treatment investigations. (Bean-AWWARF)

DETECTING TASTE AND ODOR IN DRINKING

WATER, Drexel Univ., Philadelphia, Pa. Dept. of Chemistry; and Drexel Univ., Philadelphia, Pa. Dept. of I. H. Suffet, and S. Segall.

Journal of the American Water Works Associa-tion, Vol 63, No 9, p605-608, September 1971. 1

Descriptors: \*Taste, \*Odor, \*Potable water, \*Water quality, Organoleptic properties, Water pollution effects, Biological properties, Chemical properties, Organic compounds.
Identifiers: Threshold odor number, Threshold

odor concentration, Carbon adsorption method, Liquid-liquid extraction.

Drinking water, even when physiologically safe, must be free of tastes and odors if it is to be acceptable by the populace. Tastes and odors in water supplies will increase in the future. Criteria for the development of drinking water standards for trace organics are presented. Organic compounds are the main cause of organoleptic properties in water supplies. These organics may also toxic effects. Both threshold odor n (TON) and threshold odor concentration (TOC) concepts are used to quantify odors. The analytiolation techniques that have been considered for taste-and-odor study of water include: distillation, carbon adsorption method (CAM), liquid-liquid extraction (LLE), and freeze concentration. The phenomena of taste and odor, and the means of quantifying them are not satisfactorily understood. Water-quality problems may be better understood if an interdisciplinary approach involving experts from different disciplines were utilized by a water department. (Andrews-AWWARF) W72-10372

CROSS-CONNECTION CONTROL AT LOS AN-GELES, Los Angeles Dept. of Water and Power, Calif.

Los Angeles Dept. of water and rower, Cant.

E. J. Havlina, and J. F. Wickser.

Journal of the American Water Works Association, Vol 60, No 7, p804-808, July 1968.

Descriptors: \*Water pollution control, Standards, Water distribution (Applied), Water quality, In-spection, Path of pollutants, \*Water quality con-Identifiers: Cross connections, Ba Backflow prevention, Los Angeles (Calif).

Cross-connection inspection began in Los Angeles in 1933. Since then, the program has expanded to include the harbor areas, military contract users, and all hospitals. Since 1953, the emphasis has been on protecting the public water system, rather than correcting customers' in-plant water systems. The degree of hazard to the public supply from the customer's system determines whether he will be required to install air-gap separation or a reduced pressure principle backflow prevention device (high degree of hazard) or a double check valve prevention device (lower degree of hazard) at service connection points. These devices must be regularly tested by licensed testers. (Weir-AWWARF) W72-10373

DETERIORATION OF WATER QUALITY IN DISTRIBUTION SYSTEMS

Illinois State Water Survey, Urbana

T. E. Larson. Journal of the American Water Works Association, Vol 58, No 10, p1307-1316, October 1966. 2 tab 7 ref.

Descriptors: "Water quality, "Water quality control, "Distribution systems, Biodegradation, Chemical degradation, Water treatment, Materials Correction Control of the Cont als. Corrosion. Construction. Design. Maintenance, Iron oxides, Slime, Management, Color chemical reactions. Mud. Identifiers: Alum, Manganese dioxide, Tubercula-

The deterioration of water quality occurs between the treatment plant and the household tap. The observable effects of the many types of deterioration are numerous. The major problems of deterioration should be found primarily in old segments of the distribution system. These segments suffer from the presence of mud, alum, iron oxide, manganese dioxide, slime deposits, or corrosion. Aside from disorders of age, disorders of quality control that are either biologic or chemical take place. Usually a plan is developed to deliver quality water to the consumer. Such plans frequently fail because inadequate attention is given to proper design, construction, use, maintenance, and management. Treatment practices produce quality water at the plant outlet. However, they are inadequate to overcome deterioration in the distribution system. Rehabilitation of the old segments or new additions to the distribution system should be made with the best material available. Quality product cannot be obtained from low quality materials and personnel. (Andrews-AWWARF)

CROSS-CONNECTION CONTROL PROGRAM,

Seattle Dept. of Water, Wash. J. C. Ramey, and N. R. Angvik. Journal of the American Water Works Associa tion, Vol 60, No 2, p213-220, February 1968. 1 tab,

Descriptors: Quality control, \*Water treatment, \*Water quality control, Distribution systems, \*Water pollution control, Potable water, Pressure.

Identifiers: Cross-connection control, Backflow, Air gap separation.

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Through proper treatment, safe and potable water supplies can be obtained from grossly contaminated raw water. Because of inadequate controls of cross-connections between potable water supplies and sources of pollution, water quality deteriorates as it is transported and delivered to the consumer. Legally it is the responsibility of the water purveyor to see that the water is protected from its source of supply to the point of use. Every public water supply system should have a cross-connection control program. Adequate positive pressure in the water mains protects against backflow due to back-siphonage. Air gap separation and mechanical backflow preventing devices are used to control backflow problems. Public awareness is essential to the success of a cross-connection control program. Data related to crossconnection control program. Data related to cross-connection control programs for the period 1945-1965 are presented. Also presented are Seattle's problems as to its development, enforcement, and implementation of its cross-connection control program. (Andrews-AWWARF) W72-10375

CONTROL OF CORROSION IN WATER

Electro Rust-Proofing Corp., Belleville, N.J. J. A. Lehmann.

Journal of the American Water Works Associa-tion, Vol 56, No 8, p1009-1018, August 1964. 7 fig.

Descriptors: \*Corrosion control, \*Anodes, \*Cathodes, \*Cathodic protection, Pipes, Deterioration, Electrolytes, Electrolysis, Rusting, Materials.

Identifiers: Impressed current, Dry cell concept, Galvanic systems.

Because of today's high cost of materials and labor, engineers should use every means available to prevent material waste through corrosion. The dry cell concept is used to explain the corrosion reaction. The corrosion cell begins to function once an electric potential is established through editor: different metals in the same electrolyte, a single metal with variations of dissimilarities in composition, or the same or different metals exposed to heterogeneous environments. Corrosion control can be achieved by: electrically insulating the anode from the cathode, insulating of structure from electrolyte, treatment of electrolyte, use of nonmetallic materials, or cathodic protection. Galnonmetallic materials, or cathodic protection. Galvanic anode and impressed-current systems are used to control corrosion. The parameters used in choosing and designing the proper protective system are discussed. Recent developments, such as the development of automatic potential control system and new anode materials, have made the cathodic protection more economical and effective in preventing waste through corrosion. (Andrews-AWWARF) nonmetallic materials, or cathodic protection. Gal-

VALUE AND LIMITATIONS OF CHLORINE RESIDUALS IN DISTRIBUTION SYSTEMS, Public Health Service, Washington, D.C. Div. of Sanitary Engineering Services.
H. A. Faber, J. R. Baylis, N. H. Kuehn, Jr., M. P. Crabill, and E. J. Umbenhauer.
Journal of the American Water Works Association, Vol 51, No 2, p215-233, February 1959. 9 tab, 156 Acre

Descriptors: \*Chlorine, \*Coliforms, \*Water pollu-tion treatment, \*Disinfection, Water distribution (Applied), Bacteria, Organic matter, Water quality control, Standards, District of Columbia. Identifiers: Chicago (III), Indianapolis (Ind), El

Maintenance of chlorine residuals throughout the distribution system helps safeguard against contamination caused by negative pressure, leaks, and other conditions. Residual chlorine does not affect

iron pipe but may increase the corrosion of brass pipe. High water temperatures sometimes prevent residuals from reaching far ends of the system. Samples under these conditions show higher coliform counts. A survey of thirty plants shows a use of an average chlorine dosage of 4.28 ppm in prechlorination and 1.30 ppm in postchlorination, and general agreement on the value of chlorine for eliminating coliforms. An NAS-NRC study concluded that a standard for chlorine residuals would not be desirable for the military services and would not replace good design, construction, and supervision, but it acknowledged that residuals are useful under many conditions. (Weir-AWWARF) W72-10377

ECONOMIC EVALUATION OF TYPICAL WATER WORKS TELEMETERING SYSTEMS, Metcalf and Eddy, Inc., Boston, Mass. E. B. Cobb, J. Daneker, W. E. Nusbaum, R. Barrow, and G. D. Muller.
Journal of the American Water Works Association, Vol 55, No 10, p1297-1331, October 1963. 3 tab, 1 fig.

Descriptors: \*Telemetry, Remote sensing, \*Data transmission, Electronic equipment, Instrumentation, \*Cost analysis. Identifiers: Monroe County Water Authority (Rochester, N.Y.), Milwaukee (Wis), Fort Worth

Representatives of various water supply systems have developed estimates of costs involved in establishing telemetering devices. Initial costs cover the equipment to monitor each of selected functions, installation charges, and new telephone lines. Annual operating costs involve power, rental lines. Annual operating costs involve power, rental of telephone lines, equipment failures, preventive maintenance routines, and a spare parts inventory. Considerations in shifting to telemetering include the advantages of reliability, better control, and flexibility, the requirement for fewer personnel but better paid personnel, acceptance of a supplier service contract or training a maintenance technician. One part of the discussion briefly describes types of telemetering equipment. (Weir-AW-WARF) W72-10378 W72-10378

MAIN DISINFECTION METHODS AND OBJEC-

Indianapolis Water Co., Ind.

R. J. Becker, J. R. Rossum, and H. B. Russelmann. Journal of the American Water Works Associa-tion, Vol 61, No 2, p79-84, February 1969. 3 fig, 2

Descriptors: \*Disinfection, \*Chlorine, \*Water pol-lution treatment, \*Conduits, Chlorination, Califor-nia, Construction, Impaired water quality, Water distribution (Applied). Identifiers: Indianapolis (Ind), Tablet disinfection.

For disinfecting new mains, two 150 lb. chlorine cylinders, a gasoline engine, and other components are mounted on a trailer operated by a three-man crew. Strong chlorine solution of 100 oppm is maintained in new mains for 48 hours, fol-lowing which mains are flushed until normal residuals are recovered. In the tablet method, hypochlorite tablets are glued to the upper sur-faces of new pipes as they are installed. This is more convenient than chlorine solutions and successfully treats annular dead space created by couplings. Current public health goals for water distribution systems are freedom from disease and distribution systems are freedom from disease and other hazards, and convenience, accomplished by storing and handling of water pipes and appurtenances so as to prevent contamination, main flushing to wash away contaminants, destruction of residual organisms by chlorination. Presently, coliform measurement is a test for effectiveness of disinfection. (Weir-AWWARF)

BIOLOGIC DEGRADATION OF RUBBER GASKETS USED FOR SEALING PIPE JOINTS, Netherlands Waterworks Institution, Rijswijk.

Journal of the American Water Works Association, Vol 60, No 9, p1070-1076, September 1968. 3

Descriptors: Bacteria, \*Construction materials, \*Sealants, Maintenance, Impaired water quality, Conduits, Water distribution (Applied), \*Biodegradation, Pipes, Joints (Connections).
Identifiers: \*Rubber gaskets, Synthetic com-

Different rubber compounds were tested for their resistance to biologic attack. Strips were immersed in a basin through which a slow and constant flow of potable water was maintained. The basin was covered to prevent algal growth and kept at a temperature of 20-25C. Unchlorinated groundwater, rich in nutrients such as phosphates was used. A deteriorated ring served as source of infection. None of the synthetic compounds, including nitrile, neoprene, ethylene-propylene, and styrene-butadiene rubber were attacked. The resistance of synthetic rubber compounds was confirmed. All natural rubber and synthetic polyisoprene rubbers were attacked in the long run. It was not determined definitely what percentage of natural rubber can be worked into mixed compounds without loss of biologic resistance. (Britton-AWWARF) W72-10380

CLEANING WATER MAINS WITH FOAM

District of Columbia Dept. of Sanitary Engineer-ing, Washington. Bureau of Water Services. H. M. Stearn.

Journal of the American Water Works Associa-tion, Vol 63, No 7, p414-415, July 1971. 4 fig. 2 ref.

Descriptors: "Conduits, "Turbidity, "Cleaning, Water distribution (Applied), Hydrants, Impaired water quality, Corrosion, Costs, District of Columbia.

Identifiers: \*Polyurethane foam swabs, Tubercu-

When calcium-carbonate and iron-oxide deposits were found to be scouring loose from tubercules in unlined mains and discoloring water, a method of foam swabbing was developed to clean the mains. Soft polyurethane-foam swabs weighing 1.4 lib/cu. ft. were launched and recovered at hydrants. Fif-It were faunched and recovered at hydrants. Pri-teen to twenty swabs were entered at five-minute intervals, traveling at 2.5 fps, until the water be-hind the swab cleared up in less than one minute. Costs were \$102.40/1,000 ft. of main for labor and \$1.40/1,000 ft. for swabs. (Weir-AWWARF) W72-10381

PERIODIC INSPECTIONS OF TANKS AND

RESERVOIRS,
Montgomery (James M) Consulting Engineers,
Inc., Pasadena, Calif.
R. C. Kenmir.
Journal of the American Water Works Association, Vol 61, No 3, p145-148, March 1969. 11 ref.

Descriptors: \*Reservoir storage, \*Maintenance, Repairing, Monitoring, Inspection, Reservoir leakage, Grouting, Sealants, Seepage, Water loss, Corrosion control, Earthquakes, Groundwater, Settlement (Structural), Prestressed concrete, Reservoirs.

Identifiers: Reservoir under 'rains.

Periodic inspection is important to detect develop-ing hazards and to detect and correct structural deterioration. In general, reservoirs should be in-spected regularly for earth movements, un-derdrain flow increase, leakage, and settlement. Voids under the lining should be filled by grouting. Metal surfaces, sluice gates, and other appur-tenances and vents should be checked. In addition,

## Group 5F-Water Treatment and Quality Alteration

earth embankment reservoirs should be checked for a rise in phreatic surface and evidence of for a rise in pineauc surface and evidence of seepage or gophers. In concrete reservoirs with evidence of leakage, sealants or membranes should be used and underdrains may be constructed to counteract cracking due to hydrostatic uplift. Wire corrosion is the chief concern in prestressed concrete tanks. Reservoir roofs must be guarded against storm damage, vandalism, and natural deterioration. Steel tanks must be ex-amined for differential settlement and condition of int. (Weir-AWWARF) W72-10383

POTABLE-WATER STORAGE RESERVOIRS,

Philadelphia Water Dept. Pa. E. L. Bean, R. L. Derby, E. B. Evans, and W. J.

Journal of the American Water Works Associa-tion, Vol 45, No 10, p1079-1089, October 1953. ap-

Descriptors: \*Reservoir storage, \*Reservoir construction, Reservoir operation, Potable water, Water quality, Water distribution (Applied), Water pollution, Water storage, Water quality control, Design.

Identifiers: \*Open reservoirs, \*Covered reser-

A 94.6 per cent response was received on questionnaires surveying attitudes toward open reservoirs which were sent to all state and provincial engineers in the United States and Canada. Respondents unanimously preferred covered reservoirs. Most felt it was practical to recommend all future installations be covered, did not officially approve of open reservoirs, felt they should be fenced, and felt that public recreation should not be permitted around them. Open reservoirs are subject to direct pollution from birds, animals, rodents, windblown and atmospheric contaminants, and human pollution, and to in-direct pollution due to poor flow-through circulation and lack of treatment of influent and stored water. Protective measures include location above groundwater level, grading, contamination-proof discharge pipes, covers, and good management. Cleaning and subsequent disinfection should be carried out in a manner to prevent contamination of distribution. (Weir-AWWARF) W72-10384

## 5G. Water Quality Control

CHARACTERISTICS OF MANURE ACCUMU-LATIONS REMOVED FROM OUTDOOR, UN-PAVED, BEEF CATTLE FEEDLOTS, Agricultural Research Service, Lincoln, Nebr. For primary bibliographic entry see Field 05B.

PLASTIC OIL BARRIER, Esso Production Research Co., Houston, Tex.

T. W. Childers. U. S. Patent No. 3,653,213, 2 p, 7 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 897, No. 1, p. 44, April 4, 1972.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, \*Oil wastes, Barriers, Seawater, Pollution abatement, Water pollution, Water pollution treatment, Equipment, \*Plastics, Separation techniques.

A floatable plastic barrier is used to contain oil spills. It is molded on-site in the required shape and secured to an elongated flexible section. The flexible section is actually a cable to which the barrier is bonded directly or attached by clips as the barrier and cable are fed onto the water. The plastic barrier is molded to a 90 degree V shape. Vertical drain holes may be punched or drilled at intervals along the length of the barrier to prevent aplach from esthering in the V Mooring light great. splash from gathering in the V. Mooring lines may be attached to the barrier as needed. (Sinha-OEIS)

W72-09792

OIL FILM CONTAINMENT APPARATUS, Esso Production Research Co., Houston, Tex.

(Assignet).
L. D. Woody, Jr.
U. S. Patent No. 3,653,214, 3 p. 6 fig. 2 ref; Official Gazette of the United States Patent Office, Vol. 897, No. 1, p. 44, April 4, 1972.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, \*Oil wastes, Equipment, Pollution abatement, Water pollution, Water pollution treatment, Barriers, Wave action Separation techniques.

The barrier consists of an elongated buoyant section having a trianglular cross-section with the tri-angle having slightly rounded identical sides. It is arranged in the water so that a line from the vertex of the triangle perpendicular to the base coincides with the water level. The length of the line is several wave lengths in magnitude so that it serves as a dampener of wave amplitude and also to pervent oil from being trapped under the buoyant section and from passing over it. (Sinha-OEIS) W72-09793

METHOD AND APPARATUS FOR CONFINING AND COLLECTING OIL LEAKAGE, Cerebro-Dynamics, Inc., Oklahoma City, Okla.

(Assignee).

V. S. Patent No. 3,653,215, 4 p, 7 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 897, No. 1, p. 45, April 4, 1972.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, \*\*Oil wastes, Pollution abatement, Equipment, Separation techniques, Water pollution, Water pollution treatment, \*\*Leakage.

Identifiers: \*Oil leakage.

The collector is in the form of a buoyant ring with an anchor ring suspended below the buoyant ring by cables. A thin, flexible wall or shield connects the anchor ring with the buoyant ring. When the collector is positioned over an underwater source of oil leakage, the anchor ring is lowered until it rests on the underwater surface encircling the leak. The oil collects at the surface of the water in the interior of the ring. (Sinha-OEIS)

OIL SKIMMING METHOD AND APPARATUS, Ocean Pollution Control, Inc., Dallas, Tex. (Assignee).

H. J. Fitzgerald.

U. S. Patent No. 3,653,510, 4 p, 5 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 897, No. 1, p. 118, April 4, 1972.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, \*Oil wastes, Equipment, Pollution abatement, Water pollution, Water pollution treatment, Separation techniques.

The oil skimming equipment consists of a towed funnel assembly, a bottom panel of netting, and a sump at the apex of the funnel to receive the oil for transfer to a vessel. The funnel assembly has a flexible cover and side skirts of impermeable sh material with floats to keep the leading edge of the cover spaced above the surface of the water so that the oil film will pass beneath it. The bottom netting holds the side skirts projecting downward to confine the oil laterally, while permitting the water beneath it to escape freely. (Sinha-OEIS)

SEWAGE AND MUNICIPAL REFUSE LIQUID PHASE COKING PROCESS, Texaco, Inc., New York. (Assignee). H. V. Hess, R. F. Wilson, and E. L. Cole.

U. S. Patent No. 3,652,405, 3 p, 1 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 4, p. 1427, March 18, 1972.

Descriptors: \*Patents, \*Domestic wastes, \*Industrial wastes, Pollution abatement, Separation techniques, Waste water treatment, Water pollution

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This process consists of the following steps: shredding solid refuse from which hard to reduce or large particulates have been removed; slurring the shredded material with a recycle stream of the shredded material with a recycle stream of water resulting from a subsequent coking step; removing noncombustible materials from the resulting slurry; mixing the slurry with sewage sludge; and coking the resulting mixture under pressure sufficient to prevent the vaporization of water thereby yielding grease, clean water and clean coke. (Sinha-OEIS) W72-09803

POLLUTION SUCTION WATER SWEEPER,

U. S. Patent No. 3,651,943, 6 p, 15 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 4, p. 1322, March 28, 1972.

Descriptors: \*Patents, \*Oil spills, \*Oil wastes, Oil pollution, Flotsam, Pollution abatement, Equipment, Water pollution, Water pollution treatment.

A floating vessel is provided with a suction water A floating vessel is provided with a suction water sweeping apparatus including a swinging boom. The boom is a suction swing pipe having a swivel joint connection to an inlet pipe of a suction pump. The suction pump and swivel connection are at the bottom deck level below the water line. The upper free end of the swing pipe carries a scoop structure having a direct connection to the swing pipe with the scoop structure disposed at the water level to gather the pollutants and water. The clear water is returned to the water surface by a special discharge pipe. (Sinha-OEIS) W72-09804

OIL SLICK CONFINEMENT EQUIPMENT,

E. Flaviani. U. S. Patent No. 3,651,647, 4 p, 11 fig, 3 ref; Offi-cial Gazette of the United States Patent Office, Vol. 896, No. 4, p. 1246, March 28, 1972.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, Pollution abatement, Equipment, Water pollution, \*Oil wastes, Pontoons, Barriers.

The equipment consists of a group of individual watertight floatable barrels rising above the water and affording a barrier to confine the oil slick or other pollutants. Universal joints connect adjacent barrels to one another so that the individual barrels pitch and roll with the water yet confine the pollutant. (Sinha-OEIS) W72-09805

PNEUMATIC BARRIER SYSTEM FOR WATER SURFACES,

H Grunau N. Ordinau. U. S. Patent No. 3,651,646, 3 p, 7 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 4, p. 1246, March 28, 1972.

Descriptors: \*Patents, \*Oil spills, \*Oil pollution, Air, Bubbles, \*Flotsam, Separation techniques, Equipment, Water pollution. Identifiers: \*Air bubbles, \*Pneumatic barriers.

To confine oil spills or flotsam until collected or chemically dispersed, a curtain or barrier of air bubbles is generated. At the surface the air bubbles form a series of overlapping aerated water hills capable of blocking the passage of a pollutant, such as oil film. The system may be installed on harbor or waterway bottoms where silty conditions exist. It consists of an underwater conduit to be arranged in a geometric pattern. The conduit has air escapement openings located in a given spaced relation along its length. Pressurized air is ejected and conducted to the surface. (Sinha-OFIS) W72-09806

CYANIDE REMOVAL, Calgon Corp., Pitaburgh, Pa. (Assignee). D. G. Hager, and J. L. Rizzo. U. S. Patent No. 3,650,949, 3 p, 8 tab, 2 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 3, p. 1072, March 21 1972.

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Descriptors: \*Patents, \*Industrial wastes, \*Chemical wastes, Waste water treatment, Pollution abatement, Pollutants, Water pollution, Water pollution treatment, Wastewater, Toxicity, \*Activated carbon, \*Chemical reactions. Identifiers: \*Cyanide.

To remove cyanide from water, copper salts and oxygen are added to the water upstream of a bed of activated carbon. The copper complexed cyanide is adsorbed on the activated carbon, which catalyzes the oxidation of the cyanide to carbon dioxide and nitrogen. (Sinha-OEIS) W72-09807

OIL COLLECTION RETRIEVAL SYSTEM. Ocean Systems, Inc., New York. (Assignee). L. S. Brown, F. A. March, R. P. Bishop, and B. C.

U. S. Patent No. 3,650,406, 3 p, 2 fig, 6 ref; Official Gazette of the United States Patent Office, Vol.896, No. 3, p. 950, March 21, 1972.

Descriptors: \*Patents, \*Oil wastes, \*Oil spills, \*Oil pollution, Pollution abatement, Equipment, Water pollution treatment, Separation techniques.

A catch basin consists of a floating boom, a floating weir, and a flexible support device. The weir consists of a buoyant upper section and a water absorbent lower section serving as the ballast for the upper section. Two tow boats are connected to the opposite ends of the boom. The boom and weir assume a parabolic contour in response to water currents and/or tow movement. Oil is trapped by the boom and is funneled toward the weir where part of the accumulated oil will pass through two passages into the interior of the catch basin from which it may be removed by pumping through discharge lines and into the receiving vessel. (Sinha-OEIS) W72-09808

BOOM FOR OIL-SOAKED FLOATING MATERIAL,

R. R. Ayers. U. S. Patent No. 3,648,463, 3 p, 3 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 2, p. 470, March 14, 1972.

Descriptors: \*Patnets, \*Oil spills, \*Oil wastes, \*Oil pollution, Pollution abatement, Water pollution, Water pollution treatment, Separation techniques, Equipment.

To collect oil-soaked material from a water surface, an elongate buoyant boom is provided with a foraminous skirt. An impervious shaped section is secured to the bottom of the skirt to react against water movement under the boom. A spreader bar is used to maintain the top and bottom of the skirt a predetermined distance apart. (Sinha-OEIS) W72-09814

FOR PURIFYING POLLUTED DEVICE WATER.

Orenstein-Koppel und Lubecker Maschinenbau A.G. (West Germany). F. Engelbart.

U. S. Patent No. 3,647,081, 3 p, 5 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 896, No. 1, p 137, March 7, 1972.

Descriptors: \*Patents, \*Water purification, Water pollution, \*Water pollution treatment, Pollution abatement, Separation techniques, Biological treatment equipment.

The drivable immersion body consists of a tubular closed-surface drum with at least one hose tube wound on its surface. Coils extend along its surface in a transverse direction. Means are provided for movement of the drum out of the water for ex-posure to oxygen in the air. (Sinha-OEIS) W72-09818

FOCUS ON WATER POLLUTION ABATE-For primary bibliographic entry see Field 05D. W72-09846

WHAT'S THE U.S. ARMY DOING IN WATER

POLLUTION CONTROL.
Environmental Science and Technology, Vol 4, No 12, December 1970, p 1101-1102.

Descriptors: \*Water pollution control, \*Permits, \*Federal jurisdiction, Discharge lines, Federal project policy, \*Pollution abatement, Pollutant identification, Navigable waters.

Identifiers: 1899 Refuse Act, National Environ-mental Policy Act, 1969 (P. L. 91-190), P. L. 91-224 section 21 (b).

The U.S. Army's Corps of Engineers has a new regulatory role in pollution control which extends their permit granting authority to include all discharges or deposits into the navigable waters of the United States. Authority for the Corps' ex-panded program came from a combination of the Refuse Act of 1899 and the National Environmental Policy Act of 1969 (P.L. 91-190). A proposed in-teragency agreement credited to Robert E. Jordan. the Army's General Counsel, between the Corps of Engineers and the Federal Water Quality Ad-ministration (FWQA) identified the manner in which the two agencies would cooperate to en-force the 1899 Refuse Act. The agreement has been delayed by executive reorganization creating the Environmental Protection Agency. The FWQA waste water profile inventory would be used in the permit system. The Corps' Office of used in the permit system. The Corps Office of Chief of Engineers, the Civil Works Directorate, headed by Maj. Gen. Frank P. Koisch has respon-sibility for the permits program. State certification of discharges required under section 21 (b) of P. L. 91-224 would have to be obtained before any Corp's permit could be issued. The Corps' sixmember advisory board was established in April 1970, representing a broad range of environmental knowledge and experience. It is hoped that the board will assist in providing communications and technical information exchange between the regulatory agencies and the industries. (Galwardi-Texas) W72-09853

OIL DUMPING BY U.S. NAVY. Congress, Washington, D.C.; and House, Washington, D.C.

In: Oceanography Miscellaneous, Hearings.-Sub-comm. on Oceanography.-Comm. on Merchant Marine and Fisheries, House of Representatives, 91st Cong, December 9, 10, 1970, p 191-337. 7 fig, 18 tab, 72 ref, 7 append.

Descriptors: \*Oceanography, \*Administrative agencies, \*Oil wastes, \*Water resources development, Administration, Regulation, Water pollution sources, Seawater, Oil, Waste disposal, Ships, Water quality control, Colleges, Long-term planning, Organizations, Federal government, Accidents, Legal aspects, Legislation.

The House Subcommittee on Oceanography of the Committee on Merchant Marine and Fisheries held hearings related to various oceanographic activities. Testimony was received concerning a bill amending the Marine Resources and Engineering Development Act which would continue the life of the National Council on Marine Resources and Engineering Development. Various federal agen-cies submitted their views on the bill. Most federal agencies agreed that the Council should be continued in order to promote a strong national program in the marine sciences. Hearings were also held on a bill granting additional funds to the sea grant program. Testimony was heard on the results of the 'Tektite' program, which seeks to study the effects of long-term isolation through underwater laboratories. The dumping of oil by the Navy in the Atlantic Ocean off the northern coast of Florida was investigated. The Committee also considered the larger question of what should be done to provide adequate onshore means for the disposal of waste oil from ships, and to develop effective means for ships to clean their tanks without substantial oil discharge. (Smiljanich-Florida) W72-09890

CONSTITUTIONALITY OF LOCAL POLLU-TION CONTROL BILL, (FLORIDA ATTORNEY GENERAL'S OPINION), Florida State Dept. of Legal Affairs, Tallahassee. For primary bibliographic entry see Field 06E. W72-09892

MARINE ENVIRONMENT AND POLLUTION CONTROL, THE FUTURE OF THE SEA,
Congress, Washington, D.C.; and Senate, Congress, Wash Washington, D.C. For primary bibliographic entry see Field 06E. W72-09895

CONGRESS AND FEDERAL POLLUTION CON-TROLS.
For primary bibliographic entry see Field 06E.

TALLAHALA CREEK LAKE, PASCAGOULA RIVER BASIN MISSISSIPPI (DRAFT ENVIRON-MENTAL IMPACT STATEMENT). Army Engineer District, Mobile, Ala. For primary bibliographic entry see Field 08D.

OIL POLLUTION REGULATIONS (DRAFT EN-VIRONMENTAL IMPACT STATEMENT). Coast Guard, Washington, D.C.

Available from the National Technical Information Service as PB-205 228D, \$3.00 in paper copy, \$0.95 in microfiche. December 28, 1971. 4 p.

Descriptors: \*Environmental effects, \*Oil pollu-tion, \*Coast Guard regulations, \*Navigable waters, Oily water, Water pollution sources, Ships, Standards, Law enforcement, Oil spills, Monitoring, Operations, Oceans, Offshore platmonitoring, Operations, Oceans, Orisinote pia-forms, Coastal structures, Design criteria, Design standards, Construction, Water pollution control, Federal Water Pollution Control Act, Regulation. Identifiers: \*Environmental impact statements.

The Coast Guard intends to issue regulations The Coast Guard intends to issue regulations governing the design, operation, and construction of vessels operating in navigable waters and the contiguous zone of the United States. The regulations would also cover design, construction, and operation of offshore facilities engaged in bulk transfer (over 10,000 gallons) of oil from ships. The purpose of the regulations is to reduce the probability of accidental or intentional release of oily wastes during normal operations and minor collisions. The regulations emphasize operational oily wastes during normal operations and minor collisions. The regulations emphasize operational controls. The regulations will be issued pursuant to the Federal Water Pollution Act. The probable environmental impact is a general reduction of oil discharges into U.S. waters. Alternatives include: issue only prohibitory regulations and enforce rigorously; issue extensive and detailed regulations governing all possible oil transfer operations; and a combination of these two. The latter course has been selected because it maximizes environ-

## Group 5G-Water Quality Control

mental protection within economic and practical bounds. No irreversible or irretrievable commitment of environmental resources is involved. (Grant-Florida) W72-09899

PROPOSED WATER TREATMENT FACILITIES FOR FOSS RESERVOIR, OKLAHOMA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Department of Housing and Urban Development, Fort Worth, Tex. Region VI. For primary bibliographic entry see Field 05F.

REPRESENTATIVE VANDER JAGT OFFERS ANTIWATER POLLUTION AMENDMENTS TO Washington, D.C.; and House, Congress, Wash Washington, D.C.

For primary bibliographic entry see Field 06E.

W72-09908

UNITED STATES V. ARMCO STEEL CORP. V. RUCKELSHAUS (SUIT PREDICATED ON RIVERS AND HARBORS ACT TO ENJOIN DISCHARGE OF CERTAIN EFFLUENT For primary bibliographic entry see Field 06E.

W72-09915

NAVIGATION PROJECT, MISSISSIPPI RIVER, FORT MADISON, IOWA. COMMERCIAL BOAT HARBOR, FORT MADISON, IOWA (FINAL ENVIRONMENTAL IMPACT STATE-

Army Engineers District, Rock Island, Ill. For primary bibliographic entry see Field 04A.

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT.
For primary bibliographic entry see Field 06E.

LIVESTOCK WASTE MANAGEMENT AND POLLUTION ABATEMENT.

Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, American Society of Agricultural Engineers, St. Joseph, Michigan, 1971, ASAE Publication PROC-271, 360p.

Descriptors: \*Farm wastes, \*Odors, Economics, Drying, \*Aerobic treatment, Runoff, Cattle, Swine, Poultry, Dust, \*Aerobic lagoons, Hydraulic structures, Water pollution control, Waste water treatment, Waste disposal, \*Pollution abatement.

Identifiers: \*Solid-liquid separation, Canada, Europe, \*Anaerobic lagoons.

The proceedings of the International Symposium on Livestock Wastes includes approximately 100 papers. The topics include waste disposal systems, eef feedlot systems, legal and administrative considerations, characteristics, hydraulic transport, composting, drying, economics, aerobic treatment and storage, land disposal, refeeding, and solidliquid separation. Contributions were received from Canada and Europe, as well as the United States. Each paper attempted to demonstrate techniques that allow the coordination of various waste treatment units into workable systems. Research of more than 200 scientists from 30 states and 9 nations was reported. Some were rather novel approaches that might be several years from acceptance and others are modifications of known technology with good prospects for more immediate acceptance. (See W72-09941 thru W72-10039) (Bundy-Iowa State) W72-09940

ANIMAL WASTES AND AMERICA THE BRAU. TIFUL.

ent of Agriculture, Washington, D.C.

Department of Agriculture, washington, D.S.
N.D. Bayley.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 6-7.

Descriptors: \*Farm wastes, Confinement pens, Odors, Nutrients, Pathogens, Waste disposal, Economics, \*Research priorites.

Along with the moving of animals from open range to confinement pens came waste man problems including odors, nutrients, and disease. All of these should be managed in such a way to make America more beautiful and a better place to live. The highest item on research priorities should be to find more and better ways to dispose of organic wastes on land. The next priority should be to control odors from wastes. Very little is known about this problem. A third priority for research should be to look at the entire technology required to deal with animal wastes. This would include starting with the feed produced for the animal to the disposal of the animal waste. Research must able to evaluate all costs and benefits - tangible values such as outdoor recreaction and fish and wildlife enhancement, secondary benefits that are to some extent quantifiable, such as benefits to the economy - local, regional, or natural and intangible benefits we have not always considered, such as the preservation of natural beauty. (See also W72-09940) (Bundy-Iowa State) W72-09941

FUTURE PROSPECTS FOR ANIMALS AGRICULTURE,

Ohio State Univ. Columbia. Coll of Agrigulture and Home Economics,

R. M. Kottman, and R. E. Geyer.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 9-18, 18 tab.

Descriptors: \*Farm wastes, Economics, Income, Agriculture, Livestock, Poultry. Identifiers: Diet-health relationships.

The opportunity for U.S. animal agriculture to provide larger supplies of all animal products during the next 30 years offers an exciting challenge. United States animal agriculture will however, face stiff competition from other food sources, but such competition will assist the U.S. animal agriculture by forcing it to remain progressive. To remain competitive, United States livestock and poultry producers, as well as processors of animal products are challenged to: (1) produce continually higher quality products on the farm with greater efficiency; (2) develop and implement dramatic new methods to control pollution and to utilize waste resources; (3) develop new, low-cost, convenient and tasty foods from animal sources: (4) encourage expansion of research designed climinate current unknowns regarding diet-health relationships; (5) DEVELOP AND IMPLEMENT NEW AND GREATLY EXPANDED PROGRAMS TO EDUCATE CONSUMERS AS TO THE HEALTH AND NUTRITIONAL PROPER-TIES OF ANIMAL FOODS; (6) substantially increase industry-wide consumer marketing programs, especially zeroing in on the markets for protein, calcium, iron and other animal-derived nutrients essential to human growth and health. (See also W72-09940) (Bundy-Iowa State)

ROLE OF STATE DEPARTMENTS OF AGRICULTURE IN PROBLEMS OF ANIMAL WASTE MANAGEMENT, National Association of State Departments of

Agriculture, Washington, D.C. S. Cath.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium

on Livestock Wastes, Ohio State University, April 19-22, 1971. p. 21-22.

Descriptors: \*Farm wastes, \*Federal Governments, \*State Governments, \*Local Governments, Regulation, Control, Research priorities, Waste disposal

State Departments of Health, Agriculture, and Environmental Protection, and Livestock Sanitary Commissions are some of the agencies that put regulations and control on cattle, hog, sheep, and altry operations. The National Association State Departments of Agriculture, at their 1969 convention, in resolution form, urged that the Secretary of Agriculture and the land-grant universities give a higher priority to waste disposal and sittes give a nigner priority to waste disposal and requested the Congress to provide additional funds to carry out the necessary research. Also, the State and Local Governments must develop methods to prevent farm-urban confrontation on the waste and pollution problem. In the practical sense however, good regulatory enforcement of livestock waste disposal can only proceed as fast as the results of good research. Regulatory en-forcement should never exceed the state of the art. Livestock industries should not have to cope with tnfair regulatory demands that cannot be met. (See also W72-09940) (Bundy-Iowa State) W72-09943

RESPONSIBILITIES OF A PROFESSIONAL SOCIETY TOWARD URGENT SOCIAL PROBLEMS,
Texas A and M Univ. College Station. Dept. of

Agricultural Engineering. R. E. Stewart.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposi on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 23-24.

Descriptors: \*Technology, Engineering, Air pollution, \*Social needs, Environment, Urbanization. Identifiers: \*American Society of Agricultural Engineers, \*Professional societies.

Today is an age of growing doubt and mistrust of technology. Many of the benefits technology has brought to the West (and they are many) are being downgraded by the increasing concern over pollu-tion, ugly environment, exploited resources, and disregard of human values. The engineer is in-creasingly cast in the role of a mindless villain for whom efficiency is measured only by dollar profits and losses. The dilemma, as it appears to be posed for the American Society of Agricultural Engineers (ASAE) and the community of agricultural engineers, is examined from the two viewpoints of urbanization and environmental quality; both of these factors represent urgent contemporary so-cial problems. ASAE could help to reduce the urban crisis by turning massive attention to rural development, including redeployment of industry into the countryside. ASAE could help to solve the environmental problems by increased zeal in working with the public on chemical pesticides, wastes recycling, soil erosion, and wiser exploita-tion of natural resources. Such effort must be sup-ported by the will of the people, as expressed through the public budgets. The benefits of such work should be at least equal to those derived from the mighty efforts applied to outer space. Moreover, this can be done without sacrifice of any capacity for food production. (See also W72-09940) (Bundy-Iowa State)

PUTTING IT ALL TOGETHER,

N. H. Curry.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 25-26

Descriptors: \*Federal government, State govern-Budgeting, Design, Engineering, ments,

\*Research and Development, \*Planning, \*Projects, \*Project planning, Facilities, Bids. Identifiers: Contractors.

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The normal steps in the development process-from project conception to new facilities operation for institutionally or corporately-owned research and demonstration installations, as well as privatand gemonstration installations, as well as privatiley or corporately-owned waste treatment and handling units used in production operations. Some predictable problems and pitfalls are discussed. Due to the long process of development, many changes may be anticipated as the project plans develop. These include: (1) a general project pans develop. I also mixed to upgrading of the proposed quality of construction and the incorporation of more sophisticated equipment; (2) a better relation of the project facility design with the statistical design and operational design with the statistical design and operational procedures of the proposed experiments, or an improved solution to practical problems in a production facility (the time delay is not all bad); (3) changes in research, administrative, and elective official personnel; (4) project expansion or development of interdisciplinary programs; (5) continued construction cost inflation; (6) competition for finds with other excitation; (7) tion for funds with other projects; (7) a tendency of administrators in dealing with state legislatures or congress to 'horse trade', or drop smaller pro-jects in order to assure obtaining the 'big ones.' This is not necessarily bad from an overall standpoint - few administrators are promoted for think-ing small - but this is faint consolation to the in-dividual or group badly in need of a new facility. (See also W72-09940) (Bundy-Iowa State) W72-09945

SYSTEMS FOR THE DEHYDRATION OF LIVESTOCK WASTES: A TECHNICAL AND ECONOMICAL REVIEW, For primary bibliographic entry see Field 05D. W72-09946

A COMPUTER MODEL FOR STORAGE AND LAND DISPOSAL OF ANIMAL WASTES, Florida Dept. of Agricultural Engineering. Univ.,

Gainesville.

R. A. Nordstedt, H. J. Barre, and E. P. Taiganides.
In: Livestock Waste Management and Pollution
Abatement, Proceedings International Symposium
on Livestock Wastes, Ohio State University, April
19-22, 1971. p. 30-33, 6 fig, 4 ref.

Descriptors: \*Farm wastes, Computer models, Mathematical model, Waste storage, \*Waste disposal, Optimization, Nutrients, Model studies,

\*Scheduling. Identifiers: \*Manure spreading, Tank wagon, Fortran IV Language.

A model was developed for optimizing and studing long-term scheduling decisions for removing livestock wastes from storage and spreading them on agricultural lands. The storage and land disposal system was modeled as a multistage deciusposal system was moueted as a mutualgu ecci-sion process. Dynamic programming techniques were used to find the optimal disposal schedules (time and quantities). The maximum quantity which can be disposed in each time period is constrained by storage capacity, quantity of waste generated and land area available for spreading the wastes. An important feature of this model is that wasses. An important feature of this model is that most parameters are permitted to be functions of time. Transport vehicle capacity, operation times, and cost of labor are not as significant as fixed storage cost, but they were sufficiently important to merit consideration in the design and operation of the average Land availability. of the system. Land availability and nutrient effectiveness (as compared to inorganic fertilizers) as a tweness (as compared to inorganic tertuzers) as a function of time were also significant. The model is sufficiently flexible for use as a decision tool in the design of operational systems as well as for use as a simulation tool in studying storage and land disposal systems. (See also W72-09940) (Bundy-lowa State) W72-09947

LIVESTOCK WASTE MANAGEMENT AND THE CONSERVATION PLAN, Soil Conservation Service, Washington, D. C. Engineerineering Div. C. E. Fogg. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Liyestock Wastes, Ohio State University, April 19-22, 1971. p. 34-35, 2 tab, 8 ref.

Descriptors: \*Farm wastes, Aerobic lagoons, Liquid wastes, Federal Governments, Local Governments, State Governments, Groundwater, Runoff, Biochemical oxygen demand, Irrigation systems, \*Waste disposal, Waste water treatment. Identifiers: Anaerobic lagoons, Health agencies.

Waste management systems must provide for utilization or disposal of livestock wastes without pollution or surface or ground waters and without objectionable odors. A sound system should (1) divert clean water away from areas where livestock wastes are concentrated, (2) provide controlled drainage of runoff from such areas, (3) PREVENT LEACHING OF CONTAMINANTS PREVENT LEACHING OF CONTAMINANTS INTO GROUND WATER, (4) collect polluted runoff; and (5) treat or safely dispose of collected runoff. Solid manure should be removed and stockpiled until it can be safely spread on the land or deposited in the land. Liquid manure resulting from many dairy, swine and poultry operations as well as polluted runoff from concentrated livestock areas can often be disposed of by a water spreading or irrigation system utilizing the soil and plant cover for treatment. Nutrients in such wastes are used by the plants or tised up in the sail proare used by the plants or tied up in the soil pro-vided amounts applied are kept within recom-mended limits. Aerobic and anaerobic lagoons used singularly or in combination often provide at least partial treatment of liquid manure wastes. They are usually supplemented by application of the effluent to the land by land spreading or irriga-tion. (See also W72-09940) (Bundy-Iowa State) W72-09948

TECHNOLOGICAL AND TECHNICAL CON-CEPTIONS OF MANURE HANDLING IN CZECHOSLOVAKIA, Vyzkumny Ustav Zemedelske Techniky, Repy (C-

zechoslovakia).

M. Vetenii. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 36-38, 4 fig., 2 tab., 1 chart.

Descriptors: \*Farm wastes, Cattle, Litter, \*Waste disposal, Cleaning, Hogs, Economics.

Identifiers: \*Czechoslovakia, Barn cleaning,

The technology and techniques of handling swine and dairy manure are discussed. Results of laboratory and field research and experimentation, theoretical analyses and conceptions, and economical evaluations are included. Manure removal from the stables and its application on the field are described. (See also W72-09940) (Bundy-Lowe State) Iowa State)

A LAND RECYCLING LIQUID MANURE SYSTEM FOR A LARGE-SCALE CONFINE-MENT OPERATION IN A COLD CLIMATE, Department of Agriculture, Ottawa (Ontario). Engineering Research Service.
For primary bibliographic entry see Field 05D. W72-09950

MEASUREMENT OF RUNOFF AND RUNOFF CARRIED WASTE FROM COMMERCIAL FEEDLOTS, South Dakota State Univ., Brookings. Dept. of

Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W72-09951

MANAGEMENT OF BARNLOT RUNOFF TO IMPROVE DOWNSTREAM WATER QUALITY, Ohio Agricultural Research and Development Center. Wooster.
W. M. Edwards, F. W. Chichester, and L. L.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p. 48-50, 5 fig., 8 ref.

Descriptors: \*Farm wastes, Sprinkler irrigation, Runoff, Chemical analyses, Biochemical oxygen demand, Nitrogen, Phosphorus, Water quality. Identifiers: \*Biological analyses.

Quality of runoff from a small sloping barnlot is related to that of the larger farmland watershed of which the barnlot is a 0.005 part. Livestock waste reiated to that of the larger farmland watershed of which the barnlot is a 0.05 part. Livestock waste was allowed to enter the stream system for a two year period, during which time the rate, volume, and quality of runoff was measured at the barnlot and downstream site. During the third year, barnlot runoff was diverted into a temporary storage pit and subsequently distributed through a sprinkler system onto nearby pasture land. Under these conditions no effluent from the barnlot was allowed to enter the stream system. Continued hydrologic and quality evaluations defined the effect of the barnlot runoff disposal system on downstream water quality. Chemical and biological analyses of runoff samples were made to relate water quality to hydrologic performance. BOD values for barnlot samples ranged from 10 to 420 mg/l as compared to <1 to 40 mg/l for stream samples taken at the watershed outlet. Concentrations of nutrients (mg/l) in the liquid phase of the barnlot runoff ranged from 10 to 70 total N, <1 to 15 NO3 (-)-N, <1 to 30 NH4 (+)-N, 5 to 60 organic N, and 1 to 10 P. Concentrations associated with the 0.1 to 15 % w/s wold material senarated from N, and 1 to 10 P. Concentrations associated with the 0.1 to 1.5% w/v solid material separated from the U.1 to 1.3% W/v solid material separated from the runoff samples were <1 to 150 ppm NO3 (-)-N, 100 to 2,000 ppm NH4 (+)-N, 10,000 to 40,000 ppm organic N, and 300 to 1,200 ppm P. (See also W72-09940) (Bundy-Iowa State)

TRANSPORT OF POLLUTANTS FROM SLOP-ING CATTLE FEEDLOTS AS AFFECTED BY RAINFALL INTENSITY, DURATION, AND RECURRANCE.

Agricultural Research Service, Lincoln, Nebr. Soil and Water Conservation Research Div. For primary bibliographic entry see Field 05B. W72-09953

FEEDLOT MANURE MANAGEMENT IN A DESERT CLIMATE, California Univ., Davis. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-09955

LAND DISPOSAL OF CATTLE FEEDLOT WASTES, Kansas State Univ., Manhattan. Dept. of Agricul-For primary bibliographic entry see Field 05B.
W72-09956

EVALUATION OF BEEF FEEDLOT WASTE MANAGEMENT ALTERNATIVES, Oklahoma State Univ., Dept. of Agricultural Engineering. Stillwater. For primary bibliographic entry see Field 05B. W72-09957

THE WASTE PATTERN OF BEEF CATTLE ON SLATTED FLOORS, Agricultural Research Service, St. Paul, Minn. Livestock Engineering and Farm Structures Research Branch.
For primary bibliographic entry see Field 05B. W72-09958

## Group 5G-Water Quality Control

ANALYSIS OF DUCK FARM WASTE TREAT-MENT SYSTEMS, For primary bibliographic entry see Field 05D.

SOLVING THE POULTRY MANURE PROBLEM ECONOMICALLY THROUGH DEHYDRATION, Pennsylvania State Univ., University Park. Dept. of Poultry Science.

For primary bibliographic entry see Field 05D.

A FARM SCALE DAIRY WASTE DISPOSAL

Washington State Univ., Pullman. For primary bibliographic entry see Field 05D.

A TOTAL BIOCHEMICAL RECYCLE PROCESS

FOR CATTLE WASTES, Babson Bros. Co., Elmhurst, Ill. Environmental

For primary bibliographic entry see Field 05D.

THE UK RECONCILIATION OF MODERN IN-TENSIVE LIVESTOCK FARMING WITH A BASICALLY URBAN SOCIETY,

Agricultural Development and Advisory Service, London (England).

K. B. C. Jones.

United Kingdom.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 92-94. 5 tab, 6 ref.

Descriptors: \*Farm wastes, \*Animal populations, Confinement pens, Poultry, Cattle, Biochemical oxygen demand, Solid wastes, Phosphates, Nitrogen, Water pollution, Regulations. Identifiers: Council on Environmental Quality,

Intensive livestock production will continue to be centered on those parts of the UK where the soils and climate are most favorable and where workers have the technical skills, and management the financial and marketing abilities to succeed. It is most likely that as now, these units will be in lowland areas near big centers of population. Wherever possible, correlation will be maintained between size of livestock unit kept and area available for manure spreading. In time, the law may make this concept on obligation. Planning permis-sion for non-agricultural development may be refused if it is too near an existing livestock unit. Zoning may be more widespread. New developments already require the interests of vets, neighbors, planning authority, river authority and public health inspector to be met. These interests are achieving a better understanding of the farmer:s needs and of each other:s points of view. (See also W72-09940) (Bundy-Iowa States)

IMPACT OF FARM ANIMAL PRODUCTION AND PROCESSING ON THE TOTAL ENVIRON-

Ohio State Univ., Columbus, Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05C.

LITIGATION EXPERIENCES OF LIVESTOCK AND POULTRY PRODUCERS, Iowa State Univ., Ames. Dept. of Agricultural En-

gineering.
T. L. Willrich, and J. R. Miner.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 99-101. 7 ref. Descriptors: \*Farm wastes, Odor, \*Legal aspects, Water pollution, Swine, Cattle, Poultry, Missouri, Iowa, Judicial decisions. Identifiers: \*Law suits, Odor nuisance.

Several livestock and poultry producers have faced law suits from neighboring residents based upon complaints of odor and water pollution. Such public and private nuisance suits demand that producers consider the possible effects of their producers consider the possible effects of their site selection and waste management practices upon neighbors. Cases concerning three beef producers, two swine producers and a poultry growing operation are considered in detail. The physical features of the systems are described, as well as the operation of the facilities. Both swine producers were utilizing confinement facilities with manure storage facilities beneath partially-slotted floors. In the Missouri case, both localized water pollution and odors were found to have caused damages to two nearby rural neighbors. Substantial punitive damages were awarded. The case in Iowa involved odors and their influence on neighbors located approximately 300 feet north of the operation. The first hearing of the case resulted in a hung jury. The poultry operation was in north-central Iowa, about 900 feet east-southeast of a farm home. The neighbors sought both damages and injunctive relief due to odors. (See also W72-09940) (Bundy-Iowa State)

ORIGINS AND IMPLICATIONS OF ENVIRON-MENTAL QUALITY STANDARDS FOR ANIMAL PRODUCTION FIRMS, Economic Research Service, Washington, D.C. Farm Production Economics Div.

J. B. Johnson, and L. J. Connor. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium

on Livestock Wastes, Ohio State University, April 19-22, 1971, p 102-104. 14 ref. Descriptors: \*Farm wastes, Feed lots, Runoff,

Cattle, \*Legal aspects, Water pollution control, Federal Government, Local Governments, State Governments, Control, Standards, Regulation. Identifiers: \*Feed lot firms, Nebraska Pollution Control Council.

The alternative measures of minimizing pollution from animal wastes can be categorized as (1) voluntary control measures adopted by animal producers, (2) individual legal actions, and (3) statutes and regulations established by local, State, and Federal Governments. Some individual producers and producer groups have adopted abatement technologies and taken other more drastic measures such as shifting the geographic location of their operations to minimize the pollution potential of their animal production opera-tions. Certain animal production firms have been defendants in legal litigations by plaintiffs seeking to induce changes in the producers' animal production activities. Animal production firms are subject to different forms of private legal litigation, those being (a) trespass, (b) nuisance, (c) negligence, and (d) strict liability. Several local, State, and Federal Government agencies have existing statutes related to the management of animal wastes. Governmental statutes have generally implemented controls on animal production firms by (a) direct regulations such as licenses and registry requirements, (b) payments for installation of par-ticular pollution control devices or lower rates of property tax, and (c) by charges such as fines or excise taxes for discharging excessive amounts of animal pollutants. (See also W72-09940) (Bundy-Iowa State) W72-09967

IDENTIFICATION OF CARBONYL COMPOUNDS IN A SWINE-BUILDING AT-POUNDS IN MOSPHERE,

Iowa State Univ., Ames. For primary bibliographic entry see Field 05A. METEOROLOGICAL CONTROL MALODORS FROM LAND SPREADING OF LIVESTOCK WASTES, Florida Univ., Gainesville. Dept. of Agricultural

Engineering.
R. A. Nordstedt, and E. P. Taiganides.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 107-109, 9 ref, 1 fig.

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Descriptors: \*Farm wastes, Odors, Meteorology, Air pollution, Model studies, Control, Waste disposal. Identifiers: Land spreading, Odor nuisance.

One of the foremost problems in land disposal of livestock wastes is the emission of malodorous gases from these wastes and their transport into populated areas through the atmosphere. There-fore, malodors are a constraint on land spreading of livestock wastes. Chemical treatment of these wastes for abatement of malodors is usually quite expensive. The applicability of meteorological control to land spreading of livestock wastes, and the development of an air quality model to predict the odor nuisance potential from land spreading operations were investigated. Simulations with the air quality model have shown that meteorological control of malodors from land spreading of livestock wastes is possible. The model is limited by the need for data on emission rates of malodorous gases from various livestock wastes as well as the properties of these gases. Better dispersal equations and experimental determination of diffusion parameters will also assist in ap-plying the model to field conditions. See also W72-940 (Bundy-Iowa State)

CHROMATOGRAPHIC IDENTIFICATION OF MALODODORS FROM DAIRY ANIMAL WASTE.

Ohio State Univ., Dept. of Agricultural Engineering. Columbus.
For primary bibliographic entry see Field 05A. W72-09970

CONTROL OF ODORS FROM POULTRY

Agricultural Research Service, Beltsville, Md. Livestock Engineering and Farm Structures Research Branch. G. B. Willson.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 114-116, 2 fig, 1 tab, 4 ref.

Descriptors: \*Farm wastes, Odors, Dusts, Poultry, Filters, Ammonia, Control, Air pollution. Identifiers: Water spray system, Pad-type filter, Dry filters, Burlap.

Odor and, to a lesser extent, the dust in ventilation air exhausted from poultry houses constitute an aesthetic nuisance. Use of filters and water spray chambers were evaluated for their effectiveness in removing the odor and dust. Three variations of baffle impingement filters with and without a water spray were tested. Dust removal efficiencies were determined by particle counts on filters through which a measured quantity of air had been drawn. Odor strength was evaluated organoleptically. The baffle impingement filters reduced the odor although they only removed a negligible amount of dust. Introduction of a water spray ahead of the baffle improved the dust removal to around 50% and practically eliminated the odor. Control of odor and dust would enhance the desirability of poultry houses as neighbors. Use of the water spray baffle impingement filters should reduce air pollution complaints. (See also W72-09940) (Bundy-Iowa State) AMMONIA DESORPTION FROM CONCENTRATED CHICKEN MANURE SLURRIES, Agricultural Research Service, Ithaca, N.Y. Agricultural Engineering Research Div. For primary bibliographic entry see Field 05D. W72-09972

ANTIBIOTIC RESISTANCE AND RESISTANCE TRANSFER BETWEEN BACTERIAL ISOLATES IN A WASTE LAGOON, North Dakota State Univ., Fargo. Dept. of Bac-

teriology.
For primary bibliographic entry see Field 05D.

DIFFERENTIATION OF RUMINANT FROM NON-RUMINANT FECAL SOURCES OF WATER POLLUTION BY USE OF ENTERIC BACTERIA, South Dakota State Univ., Brookings. Dept. of

Bacteriology.
For primary bibliographic entry see Field 05B.

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GROWTH KINETICS OF RUMEN BACTERIA IN SOLUTIONS OF POULTRY EXCRETA, Kentucky Univ., Lexington. For primary bibliographic entry see Field 05B.

THE ROLE OF MICROORGANISMS IN THE MANAGEMENT OF ANIMAL WASTES ON BEEF CATTLE FEEDLOTS, Agricultural Research Services, Lincoln,

Nebraska.
T. M. McCalla, and L. F. Elliott.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 132-134, 2 fig, 3 tab, 28 ref.

Descriptors: \*Farm wastes, Cattle, Feed lots, Microorganisms, Pathogenic bacteria, Nitrogen, Crops, Odors.

Animal wastes on feedlots may leave the feedlot Animal wastes on feedlots may leave the feedlot by mechanical removal, runoff, percolation through the soil profile, volatilization, or decom-position. Of these mechanisms, microbial decom-position plays a major role in the rate and route of manure loss. Laboratory and feedlot studies, at Lincoln and Central City, Nebraska, indicate mechanical removal of manure from the feedlot mechanical removal of manure from the feedlot may be necessary only after several years of accu-mulation. The manure in the feedlot can be mounded to provide a protected drained area for the animals, and the manure serves as a compost pile to aid in decomposition. The feedlot studied is level with a high water table and limited runoff occurs. Laboratory studies have indicated as much as 90% of the nitrogen and 50% of the carbon in the manure and urine can be lost by decomposition in a 4-month period. Soil microorganisms can be managed to reduce odors and to dispose of animal wastes without pollution of surface or ground waters. If the surface of the feedlot is aerobic, many odor-causing compounds can be metabolized before they reach the atmosphere. It may also be desirable to maintain aerobic conditions at the feedlot surface for sanitary reasons. Laboratory studies conducted at Lincoln showed Salmonella sp. added to beef manure died rapidly under aerobic conditions but survived under anaerobic conditions. Feedlot soil atmosphere studies found high concentrations of CH4 and CO2. (See also W72-09940) (Bundy-Iowa State) W72-09976

AGITATION IN LIQUID MANURE TANKS, Tennessee Univ., Knoxville. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.

MEASURING METHOD FOR EVALUATING THE ABILITY TO PUMP SEMI-LIQUID AND MANURE, Bayerische Landesanstalt ue Landtechnik,

Weihenstephan (West Germany).
K. Grimm, and G. Langenegger.
In: Livestock Waste Management and Pollution

Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 138-141, 145, 9 fig, 10 ref.

Descriptors: \*Farm wastes, Liquid wastes, Pump testing, Measurement, Pumps.

Identifiers: Consistency factor, Manure pump, Manure consistency.

A large number of pumps are on the market; some are very well adapted to pumping liquid manure and some lack several things which one could wish for. A technical measurement for the capacity of tor. A technical measurement for the capacity of individual pumps to boost liquid manure is neces-sary in order to put the individual pumps to work at the correct place and to be able to plan liquid manure installations. Tests haves shown that all semiliquid and liquid manure mixtures may be evaluated in a relatively simple way insofar as the evaluated in a relatively simple way insofar as the ability to be pumped is concerned. Measuring manure consistency by the ball method is described. This method of measuring provides a uniform prerequisite for testing pumps and thereby makes an exact examination possible with varied semi-liquid manure mixtures with different consistencies. (See also W72-09940) (Bundy-Iowa State) W72-09978

PUMPING CHARACTERISTICS, BIOLOGICAL AND CHEMICAL PROPERTIES OF DAIRY MANURE SLURRIES, British Columbia Univ., Vancouver. Dept. of

British Columbia Univ., Vancouver. Dept. of Agricultural Engineering. L. M. Staley, N. R. Bulley, and T. A. Windt. In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 142-145, 6 fig, 2 tab.

Descriptors: \*Farm wastes, Cattle, Irrigation, Biochemical oxygen demand, Hydrogen ion concentration, Potassium, Sodium, Chloride, Ammonium, Sprinkler irrigation, Waste disposal, Design pumps.
Identifiers: \*Dairy, Piping losses.

A manure handling system has been designed to A manure nanding system has been designed to permit a zero grazing management practice and utilize above ground storage and sprinkler irrigation methods of waste disposal. Manure from the exercise yard and holding area is scraeed into a 288 cubic foot below grade sump. From this point the complete system is operated by a 30 HP electric motor and Holz helical type manure pump. The pump is used for filling the 100,000 US gallon have ground storage task; for actistion and mixabove ground storage tank; for agitation and mixing within the tank and returning the slurry to the sump for dilution if necessary, before pumping through a 4 inch diameter aluminum irrigation system to a standard No. 104 Rainbird sprinkler. BOD, COD, pH, ammonia, organic and nitrate nitrogen, total and ortho phosphate, sodium, potassium, chloride, total volatile and suspended solids were determined at bi-weekly intervals for (1) water inputs, (2) manure into and out of storage and (3) water outflows from field drains. Sampling began June 2, 1970 and will continue throughout the winter season. (See also W72-09940) (Bundy-Iowa State) W72-09979

AUTOMATED HANDLING, TREATMENT AND RECYCLING OF WASTE WATER FROM AN ANIMAL CONFINEMENT PRODUCTION UNIT, Ohio State Univ., Columbus. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D.

W72-09980

MANURE MANAGEMENT IN A 700-HEAD SWINE-FINISHING BUILDING; TWO APPROACHES USING RENOVATED WASTE

Iowa State Univ., Ames. Dept. of Agricultural En-

gineering.
R. J. Smith, T. E. Hazen, and J. R. Miner.
In: Livestock Waste Management and Pollution
Abatement, Proceedings International Symposium
on Livestock Wastes, Ohio State University, April
18-22, 1971, p 149-153, 7 fig. 2 tab, 14 ref.

Descriptors: \*Farm waste, Confinement pens, Swine, Chemical oxygen demand, Settling, basin, Oxidation treatment, Sludge, Water reuse. Identifiers: \*Flushing gutter, Anaerobic lagoon.

Iowa State University had used fresh water for flushing manure from a confinement building but difficulties in effluent disposal stopped this practice. Two systems of waste water renovation were examined. Preliminary studies showed that adequate manure removal and reduced water use adequate manure removal and reduced water use could be obtained by intermittent discharge of a tank of cleaning water. Mechanisms for controlling such discharge are described. The presence of an open flushing gutter in the pen area was found to affect defection habits very favorably, also the action of the pigs' feet improved manure transport. The effect on the pigs of exposing them to their renovated effluent was authorous, hence the first scheme included an unknown; hence, the first scheme included an unknown; hence, the first scheme included an anaerobic lagoon followed by an oxidation ditch, both external to the building. Total sludge return to the oxidation ditch was used by incorporating a settling tank. Conventional sanitary engineering measurements were made at various points in the cycle; these included oxygen demand, solids, various inorganic ions and a membrane filter count of coliform density. Tests were started in January 1969 and it was found that a stable odderless of 1969, and it was found that a stable, odorless ef-fluent of less than 150 mg/l BOD5 could easily be obtained, even at low ditch temperatures. (See also W72-09940) (Bundy-Iowa State) W72-09981

IMPROVING WATER UTILIZATION EFFI-CIENCY IN AUTOMATIC HYDRAULIC WASTE REMOVAL, Agricultural Research Service, Beltsville, Md.

Agricultural Engineering Research Div. E. E. Jones, G. B. Willson, and W. F. Schwiesow.

In: Livestock Waste Management and Pollution Abatement, Proceedings, International Symposi-um on Livestock Wastes, Ohio State University, April 19-22, 1971, p 154-158, 11 fig, 8 ref.

Descriptors: \*Farm wastes, Velocity, Automation, Hogs, Water utilization.
Identifiers: \*Automatic hydraulic waste removal,

One of the goals of the USDA Farmstead Water Systems Research is to improve water utilization efficiency in livestock sanitation. Reports of large efficiency in livestock sanitation. Reports of large volumes of water being used to remove solids from under slotted floors led to theoretical and model studies of automatic hydraulic waste removal in 1963. In 1966 certain principles developed from these studies were incorporated in a partically slotted floor swine building. A maximum design flush volume of 3 gallons per pig (300 gallons) was used. Movie film analysis of waste gallons) was used. Movie film analysis of waste removal revealed that as much as 90% of the water was discharged clear at the end of the gutter. Reducing flush volume to 160 gallons resulted in incomplete waste removal. Major factors limiting water utilization efficiency have been identified and verified in design modifications. Unsteady flow conditions and the modification of fluid properties by dissolved and suspended solids result in velocities about 30% higher than predicted by Manning's formula. Above velocities of 3 fps the relationships between waste deposition, depth of flow and duration of flow determine water utilization efficiency. Automatic hydraulic waste removal by making possible daily or more frequent waste removal will provide a batter livestock en-

## Group 5G-Water Quality Control

vironment at less cost. (See also W72-09940) (Bundy-Iowa State) W72-09982

HIGH RATE POULTRY MANURE COMPOST-ING WITH SAWDUST, North Carolina State Univ., Raleigh. Dept. of Civil Engineering. For primary bibliographic entry see Field 05D.

COMPOSTING DAIRY COW WASTES, Agricultural Research Service, Beltsville, Md. Livestock Engineering and Farm Structures Research Branch. G. B. Willson.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 163-165, 4 fig. 2 tab, 4 ref.

Descriptors: \*Farm wastes, Aerobic treatment, Cattle, Hay, Silage, Grains, Odor, Waste treatment. Identifiers: \*Composting.

Composting is a biological process for the degradation of solid wastes. It has been used to reduce municipal wastes to an odorless, stable material that may be used as a soil conditioner. The compost may be easily handled or stored. Like other biological degradation processes, the process may be either aerobic or anaerobic or a combination. The aerobic process is faster and produces more heat, which maintains the elevated temperatures required. The aerobic process, which seems to have merit for treatment of farm animal wastes, was studied. Waste from the gutter of a stanchion barn was used. Two types of bedding, straw and wood sawdust, were evaluated. Several of the process parameters have been investigated on a pilot scale with approximately one-half ton batches and on a bench scale. These parameters include air flow rate, moisture content, temperature, pH, and agitation frequency. Dry matter was reduced about 60%. The total weight was reduced about 80%, including the effect of lowering the moisture content from 75 to 50% during the process. Volume was reduced 30 to 50% on a loose basis. The final product has a faint musty odor in a moist condition. It is odorless when air dried to about 10% moisture content. (See also W72-09940) (Bundy-Iowa State) W72-09984

QUALITY OF EFFLUENT FROM FARM ANIMAL PRODUCTION SITES, Louisiana Tech Univ., Ruston. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05B. W772-09985

WATER HYACINTHS TO FURTHER TREAT ANAEROBIC LAGOON EFFLUENT, Iowa State Univ., Ames. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72.09086

ENZYME-FACILITATED MICROBIAL DECOMPOSITION OF CATTLE FEEDLOT MANURE, Colorado State Univ., Fort Collins. Dept. of Microbiology.

Microbiology. For primary bibliographic entry see Field 05D. W72-09987

WATER AND SOIL OXYGEN DEMAND OF LIVESTOCK WASTES, Ohio State Univ., Columbus. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05B. W72-0998 BOD ANALYSIS OF SWINE WASTE AS AF-FECTED BY FEED ADDITIVES, North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering. For primary bibliographic entry see Field 05C. W72-09982

PORCINE ENTEROVIRUS SURVIVAL AND ANAEROBIC SLUDGE DIGESTION, Illinois Univ., Urbana. Dept. of Microbiology; and Illinois Univ., Urbana. Dept. of Veterinary Pathology and Hygiene. For primary bibliographic entry see Field 05C. W72-09990

THROUGH-CIRCULATION DRYING OF MANURE IN SUPERHEATED STEAM, Drexel Univ., Philadelphia, Pa. Dept. of Chemical Engineering. For primary bibliographic entry see Field 05D. W72-09991

PYROLYSIS OF LIVESTOCK WASTES, Ohio State Univ., Columbus. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-09992

DRYING POULTRY WASTE, Michigan State Univ., East Lansing. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-09993

ECONOMICS OF WASTE DISPOSAL FROM CONFINED LIVESTOCK, Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics. For primary bibliographic entry see Field 05D.

MARKETING CONVERTED POULTRY MANURE, Pennsylvania State Univ., University Park. Dept. of Animal Industries. For primary bibliographic entry see Field 05E. W72.0995

THE ECONOMICS OF SWINE WASTE DISPOSAL, Environmental Research and Applications, Inc., Wilton, Conn. For primary bibliographic entry see Field 05D. W72-09996

ECONOMIC IMPLICATIONS OF ENVIRON-MENTAL QUALITY LEGISLATION FOR CON-FINED ANIMAL FEEDING OPERATIONS, Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics. For primary bibliographic entry see Field 05D. W72-09997

COST OF MAINTAINING SPECIFIED LEVELS OF WATER POLLUTION CONTROL FOR CON-FINED CATTLE FEEDING OPERATIONS FOR THE SOUTHERN HIGH PLAINS, Texas Tech Univ., Lubbock. Dept. of Agricultural Economics.

H. Y. Lee, and T. R. Owens.
In: Livestock Waste Management and Pollution
Abatement, Proceedings International Symposium
on Livestock Wastes, Ohio State University, April
19-22, 1971, p 207-208. 1 fig, 5 ref.

Descriptors: \*Farm wastes, \*Cattle, \*Agricultural runoff, Confinement pens, Feed lots, Costs, Texas, Water pollution control. Identifiers: \*Southern High Plains. The Southern High Plains of the U.S. has witnessed the rapid expansion of confined cattle feeding operations. From less than 500,000 head of fed cattle marketed in 1959, the figure increased to over 2.5 million head by 1969 in the state of Texas alone. Surplus feed grain supply, abundant feeder cattle supply, dry and mild climate, gentle terrain, and an excellent transportation network contributed to the development. Some of these factors have also contributed to serious water pollution problems. An immediate solution to the problem might be the utilization of collection basins to collect feedlot runoff for subsequent discharge to an open field or modified playa lake or alternatively left for natural evaporation. The two runoff control systems' and evaporative discharge systems' and 'evaporative discharge systems' and 25,000 head lots, respectively. This is an average cost of 8.2 cents per head of occupancy. Disposing of solid manure is still a major problem with these systems. A 'modified environment system' consisting of concrete slotted floors and a roof covering the pen area and collection pits appears promising. This type of construction is estimated at about \$75 per head, compared with \$25 per head for a typical cattle feedlot. (See also W72-09940) (Schmitt-lowa State)

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AN OXIDATION DITCH FOR THE HANDLING AND TREATMENT OF POULTRY WASTES, Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-09999

DESIGN, INSTALLATION AND BIOLOGICAL ASSESSMENT OF A PASVEER OXIDATION DITCH ON A LARGE BRITISH COLUMBIA SWINE FARM, Department of Agriculture, Abbotsford (British Columbia).

For primary bibliographic entry see Field 05D. W72-10000

BEEF WASTES AND THE OXIDATION DITCH TODAY AND TOMORROW, Minnesota Univ., St. Paul. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-10001

AEROBIC TREATMENT OF LIQUID AND SOLID POULTRY MANURE, Guelph Univ. (Ontario). For primary bibliographic entry see Field 05D. W72-10002

MICROBIOLOGICAL ASPECTS OF AEROBI-CALLY TREATED SWINE WASTE, School of Agriculture, Aberdeen (Scotland). Bacteriology Div. For primary bibliographic entry see Field 05D. W72-10003

CROP PRODUCTION AND SOIL ANALYSES AS AFFECTED BY APPLICATIONS OF CATTLE FEEDLOT WASTE, Southwestern Great Plains Research Center, Bushland, Tex. For primary bibliographic entry see Field 05D. W72-10004

A BARRIERED LANDSCAPE WATER RENOVATION SYSTEM FOR REMOVING PHOSPHATE AND NITROGEN FROM LIQUID FEEDLOT WASTE, Michigan State Univ., East Lansing. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D. W72-10005

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

## Water Quality Control—Group 5G

DISPOSAL OF BEEF MANURE BY DEEP PLOWING, Texas A and M Univ., College Station. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05E.

WATER QUALITY OF RUNOFF FROM GRASS-LAND APPLIED WITH LIQUID, SEMI-LIQUID, AND 'DRY' DAIRY WASTE, Auburn Univ., Ala. Dept. of Animal and Dairy

For primary bibliographic entry see Field 05D.

FATE OF INORGANIC FORMS OF N AND SALT FROM LAND-DISPOSED MANURES FROM DAIRIES, California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 05B. W72-10008

EFFECT OF RATE OF POULTRY MANURE AP-PLICATION ON SELECTED SOIL CHEMICAL PROPERTIES, Arkansas Univ., Fayetteville. Dept. of Agronomy.

I. H. Hileman

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 247-248, 5 fig.

Descriptors: \*Farm wastes, \*Poultry, \*Fertiliza-tion, Crop response, Salinity, Soil properties, \*Soil chemical properties, Salts. Identifiers: \*Field-spreading.

Poultry manure, especially broiler litter, is a valua-ble by-product of the poultry industry. Long-time use by farmers has indicated soil imbalance results from continuous heavy applications. On a dry weight basis, broiler litter contains 4.11% nitrogen, 1.45% phosphorus, and 2.18% potassium. Broiler litter containing 26% moisture was mixed into the upper 4 inches of Ruston sandy loam, Sharkey clay loam, and Captina silt loam, at rates of 5, 10, 15, and 20 tons per acre for a greenhouse study.

Ky-31 Fescue was planted but did not germinate. A rapid rise in soil temperature and in pH was noted on all soils. The ammonia released may react with the soil clay exchange capacity resulting in high levels of Ca, K, and Mg ions in the soil, contributing to the soluble salt level. Soil potassium levels increased greatly. High levels of potassium combined with ammonia inhibit the germination and growth of most crop plants. Even at the 5-ton and grown of most crop paints. Even at the 3-ton rate, severe salt toxicity was found on all three soils three months after litter incorporation. Salt problems can be determined by soil conductivity measurement. (See also W72-09940) (Schmitt-W72-10009

GROUNDWATER POLLUTION DUE TO HIGH ORGANIC MANURE LOADINGS, Rutgers - The State Univ., New Brunswick, N.J. Depl. of Environmental Sciences. For primary bibliographic entry see Field 05B. W72-10010

EFFECT OF MANURE HANDLING SYSTEMS ON PLANT NUTRIENT CYCLING, Wisconsin Univ., Madison. Dept. of Soil Science. For primary bibliographic entry see Field 05C. W72-10011

SUBSURFACE DISPOSAL OF LIQUID MANURE, Pennsylvania State Univ., University Park. Dept. of Soil Fertility.
For primary bibliographic entry see Field 05B.
W72-10012

AERORIC STORAGE OF POULTRY MANUEL. Greeamount Agricultural and Horticultural Coll., Muckamore (Northern Ireland). For primary bibliographic entry see Field 05D. W72-10013

SURVIVAL AND DETECTION OF LEP-TOSPIRES IN AERATED BEEF CATTLE MANURE Minnesota Univ., St. Paul. Dept. of Agricultural For primary bibliographic entry see Field 05A.

AERATION WITH ORP CONTROL TO SUP-PRESS ODORS EMITTED FROM LIQUID SWINE MANURE SYSTEMS, Illinois Univ., Urbana. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W72-10015

AEROBIC DIGESTION AND DENITRIFICA-TION OF DAIRY CATTLE WASTES, Purdue Univ., Lafayette, Ind. Dept. of Agricul-tural Engineering. For primary bibliographic entry see Field 05D. W72-10016 NITROGEN TRANSFORMATION

AEROBIC BIOLOGICAL BREAKDOWN OF FARM WASTE, Rijkszuivel Agrarische Afvalwater Dienst, Arn-hem (Netherlands). For primary bibliographic entry see Field 05D. W72-10017

LOW-VOLUME. SURFACE-LAYER, TION-CONDITIONED MANURE STORAGE, Clemson Univ., S.C. Dept. of Agricultural Eugincering. For primary bibliographic entry see Field 05D. W72-10018

SHORT TERM AERATION OF DAIRY CATTLE MANURE FOR IRRIGATION, Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D.
W72-10019

THE USE OF OXIDATION PONDS FOR POULTRY PROCESSING WASTE DISPOSAL, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-10020

ACCLIMATIZATION RESPONSE TIME FOR AEROBIC WASTE DIGESTORS, Georgia Univ., Athens. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-10021

CATTLE MANURE AS FEED FOR CATTLE, Alabama Agricultural Experiment Station, Auburn. Dept. of Animal and Dairy Sciences.

W. B. Anthony.

In: Livestock Waste Management and Pollution
Abatement, Proceedings International Symposium
on Livestock Wastes, Ohio State University, April
19-22, 1971, p 293-296, 2 fig. 11 tab, 10 ref.

Descriptors: \*Farm wastes, \*Recycling, \*Cattle, \*Animal pathology, Microorganisms, Nematodes, Feed lots, Feeds. didentifiers: \*Refeeding, Wastelage.

Manure from grain-fed steers was fermented by lactic acid bacteria and about 16% of the dry

matter was converted to lactic acid. This lactic acid was neutralized by anhydrous ammonia and the final product contained 45% crude protein equivalent. When blended with corn, the amoniated manure was readily consumed by sheep. Manure blended with ground corn in the ratio 1:1.5 (w/w) was a more efficient ration for finishing slaughter cattle than a balanced ration containing corn and supplement or corn, supplement, and ground hay. All manure voided by yearling steers fed in confinement was collected and made into red in confinement was collected and made into wastelage (57 parts manure, 43 parts ground hay). The wastelage produced daily using the excreta from one full-fed yearling steer averaged 51 pounds. A portion (6 lb.) was fed to the steer that produced the manure and the remainder (45 lb.) was fed to a beef brood cow. Cottonseed meal added to a corn-wastelage ration did not ap-preciably increase animal gain. Spread of infection of internal parasites and other common ailments of feedlot cattle did not occur when manure was fed over a long period to cattle and sheep. Larvae of common stomach nematodes did not develop in wastelage. (See also W72-09940) (Schmitt-Iowa State) W72-10023

NUTRITIVE VALUE OF CHICKEN MANURE FOR CATTLE, Cornell Univ., Ithaca, N.Y. Dept. of Animal

L. S. Bull, and J. T. Reid.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 297-300, 7 tab, 14 ref.

Descriptors: \*Farm wastes, \*Recycling, \*Cattle, \*Poultry, Animal pathology, Coliforms, Nutrient requirements, Costs.
Identifiers: \*Air dried chicken manure.

Chicken manure, as voided, contains about 75 percent water and 4 percent nitrogen. 70 percent of the nitrogen is derived from urinary sources and 30 percent from fecal matter. More than 60 percent of the total nitrogen is in the form of uric acid, 9 to 10 percent in ammonium salts and the balance is part of the fecal material. The use of urea and ammonium salts by rumen microorganisms is well documented. Acceptability, intake, digestion, and balance trials were conducted with dairy cattle and steers to determine the value of air dried chicken manure (ADM) as a source of nitrogen, calcium, and phosphorus. The dry matter content of the ADM as fed was 81.5% and the percentages of crude protein, calcium, and phosphorus were 30.1, 7.6, and 1.2, respectively. The gross energy value was 2688 Kcal per Kg as fed. Palatability was not a serious diet problem as long as the ADM contained less than 20% moisture. ADM may be used as the sole source of supplemental N for steers and dairy cows fed low-protein basal diets. N, Ca, and P in ADM are readily available and well utilized by the animal. The economic advantages for producing ADM in large quantities are significant at current cost estimates. (See also W72-09940) (Schmitt-Iowa State)

STUDIES OF PROCESSING, NUTRITIONAL VALUE, AND PALATABILITY OF BROILER LITTER FOR RUMINANTS, Virginia Polytechnic Inst., Blacksburg. Dept. of Animal Science.

J. P. Fontenot, K. E. Webb, B. W. Harmon, R. E.

Tucker, and W. E. C. Moore.
In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 301-304, 5 tab, 1 fig, 16 ref.

Descriptors: \*Farm wastes, \*Recycling, \*Poultry, Cattle, Animal pathology, Nutrients, Waste treat-Identifiers: Poultry litter.

## Group 5G-Water Quality Control

A possible public health hazard exists when poultry litter is fed to ruminants. The objectives of this research were to develop a sterilizing method which will destroy pathogenic organisms in broiler litter, to determine the effect of sterilizing methods on the nutritional value of litter, to study variation in chemical composition of litter among variation in chemical composition of utter among producers and to study the palatability of cattle rations containing litter. The use of dry heat at 150 degrees C for 4 hours or longer was the only method which was consistently effective in sterilizing broiler litter. Autoclaving and the use of beta-propiolactone or ethylene oxide did not consistently effect themical composition of litter. The sistently affect chemical composition of litter. The use of dry heat at 100 or 150 degrees C resulted in a substantial decrease in crude protein content. There was loss of ammonia upon dry heating. In a series of nitrogen balance trials with sheep, nitrogen utilization was similar for litter au-toclaved for 40 minutes, dry heated at 150 degrees C for 4 hours, or acidified to pH 6 and dry h at 150 degrees C for 4 hours. There was considerable variation in the chemical composition of poultry litter samples obtained from different areas. No substantial amounts of pesticide residues were detected in broiler litter or in tissue from animals fed processed litter. There appears to be adaptation to acceptability of litter by cattle. (See also W72-09940) (Schmitt-Iowa State)

DEHYDRATED POULTRY WASTE (DPW) AS A FEEDSTUFF IN POULTRY RATIONS, Michigan State Univ., East Lansing. Dept. of

Poultry Science. C. J. Flegal, and H. C. Zindel.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971. p 305-307. 7 tab, 9 ref.

Descriptors: \*Farm wastes, \*Recycling, \*Poultry, Dehydration, Nutrients, Waste treatment. Identifiers: Eggs, Dehydrated poultry wastes.

Poultry excreta, from caged layers, was collected and dehydrated. The resulting product of dehydra-tion (DPW) was put into the diets fed growing chicks and laying hens to determine its nutritional value. The 4 week mean body weight of leghorntype chicks was not influenced when up to 20 percent of the diet was DPW. When diets of 10 or 20 percent DPW were fed to broiler-type chicks, a significant reduction in mean body weights resulted at 4 weeks of age. Feed efficiency was inversely related to the level of DPW in the diet. In two laying experiments, involving leghorn-type laying hens, incorporation of up to 20 percent DPW did not influence egg production or feed efficiency to produce eggs. Egg quality factors were not adversely influenced by adding up to 40 percent DPW in the laying ration. Supplementation of the diets containing DPW in one experiment with calcium, phosphorus, methionine and energy had little influence on the criteria measured. The taste panel was unable to determine a difference between eggs from hens fed the control diet and eggs produced by hens fed diets containing 10, 20, and 30 percent DPW. (See also W72-09940) (Schmitt-Iowa State) W72-10026

DRIED ANIMAL WASTE AS A PROTEIN SUP-

PLEMENT FOR RUMINANTS, Michigan State Univ., East Lansing. Dept. of

Animal Husbandry. H. F. Bucholtz, H. E. Henderson, J. W. Thomas, and H. C. Zindel.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 308-310, 6 tab, 4 ref.

Descriptors: \*Farm wastes, \*Recycling, \*Poultry, Dehydration, Nutrients, Ruminants, Proteins,

Identifiers: Dehydrated poultry wastes.

A 134 day feeding trial utilizing nine yearling steers per group was employed in studying the value of dried poultry waste as a protein source for feed lot cattle. The ration was comprised of 80% corn silage and 20 percent shelled corn on a dry matter basis. Crude protein levels were adjusted to 12 percent of dry matter with one of the following protein supplements; dried poultry waste (DPW), 1/2 DPW - 1/2 urea, 1/2 DPW - 1/2 soybean meal, urea, and soybean meal. Average daily gain for the respective rations was: 2.75, 3.03, 2.88, 3.10, 3.35 pounds respectively. Gain differences were highly significant. Feed efficiency values were 10.43, 7.31, 8.14, 7.23, and 6.96 pounds respectively. The relatively poor performance of beef animals fed DPW may be related to the high proportion (32 percent) of product used in the ration. Digestibility and nitrogen balance values for sheep indicate that the animal manures can be successfully used as a source of energy and nitrogen in ruminant rations. From management and nutritional considerations, dehydrated animal wastes must contain more than 25 percent crude protein to economically compete with other supplemental nitrogen sources for rumi-nants. (See also W72-09940) (Schmitt-Iowa State) W72-10027

THE EFFECTS OF INCLUDING DRIED POULTRY WASTE IN THE FEED OF LAYING

Ministry of Agriculture, Fisheries and Food, Worcester (England). Poultry Husbandry Advisor. B. Hodgetts.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 311-313, 9 tab, 12 ref.

Descriptors: \*Farm wastes, \*Recyc \*Dehydration, Poultry, Costs, Drying, Feeds. Identifiers: Dehydrated poultry waste.

A farm trial was arranged to test the feasibility of including artificially dried poultry waste in the feed of a flock of 1800 caged laying hens. A flock of 800 birds was maintained as a control. The waste came directly from battery cages and was dried in a rotary drum type dryer. After prelimina-ry trials it was decided to use an inclusion level of 10% dried poultry waste. After 58 weeks of lay, no real differences could be detected in terms of egg yield, mortality or egg gradings. The flock receiving dried poultry waste consumed 0.27 ounces of feed/bird/day less than the control. Body weight checks showed them to be 0.21 pounds/bird heavier at the end of the trial. The overall cost of the ration was reduced to \$4.80 per ton by including dried poultry waste. This trial indicated that for the conditions prevailing it was technically, nutritionally and economically feasible to recycle poultry waste to the layers at a level of 10%. (See also W72-09940) (Schmitt-Iowa State) W72-10028

NUTRITIVE EVALUATIONS OF UNTREATED AND CHEMICALLY TREATED DAIRY CAT-

TLE WASTES, Agricultural Research Service, Beltsville, Md. Animal Science Research Div. For primary bibliographic entry see Field 05D.

BIODEGRADED HEN MANURE AND ADULT HOUSE FLIES: THEIR NUTRITIONAL VALUE TO THE GROWING CHICK,
Agricultural Research Service, Beltsville, Md.

Agricultural Engineering Research Div. . C. Calvert, N. O. Morgan, and H. J. Eby In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 319-320, 6 tab, 4 ref.

Descriptors: \*Farm wastes, \*Recycling, \*Insects, \*Larvae, Poultry, Drying, Nutrients, Feeds. Identifiers: House flies, Musca domestica.

Initial studies demonstrated the feasibility of using the house fly larvae to biodegrade or process caged laying hen manure. Studies conducted on the comparison of processed hen manure, fresh dried hen manure, and soybean meal used these materials to constitute 22% of the diet. The materials contained 2.7, 5.2 and 8.0% total Kjeldahl nitrogen, respectively. Chicks receiving the two types of manure in the three week growth studies weighed 93 grams less than those receiving soybean meal. 22% manure does not support optimum chick growth Newly emerged house flies. timum chick growth. Newly emerged house flies contain about 69% moisture, and the dry material is 75% protein and 7% fat. Dried ground adult house flies were diluted with cellulose to bring the protein content to 50% and this material was substituted in the chick diet of the growing chick. The total amount of fly meal in the chick diet was 22% and this was compared with 22% of 50% soybean meal. The adult house fly meal supports growth equally as well as soybean meal during the first three weeks of the growing period. (See also W72-09940) (Schmitt-Iowa State) W72-10030

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RECYCLING BROILER HOUSE LITTER ON TALL FESCUE PASTURES AT DISPOSAL RATES AND EVIDENCE OF BEEF COWHEALTH PROBLEMS,

Department of Agriculture, Watkinsville, Ga. S. R. Wilkinson, J. A. Stuedemann, D. J. Williams, J. B. Jones, and R. N. Dawson.

In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 321-324, 5 tab, 3 fig, 17 ref.

Descriptors: \*Farm wastes, \*Fertilizers, \*Crop response, Nutrients, Cattle, Fescues, Animal pathology.

Identifiers: Grass tetany, Nitrate toxicity, Lipo-

Grass tetany, nitrate toxicity, and lipomatosis problems have occurred with beef grazed in tall fescue pastures heavily fertilized with broiler litter. Two Kentucky-31 fescue pasture systems were initiated in 1968 with one receiving 9.3 M.T. dry broiler house litter per acre per year, and a control receiving a maximum of 202 Kg N per ha per year from inorganic sources. These pastures were treated as ecosystems and changes in soil, plant, and animal components were evaluated. Soil from the surface 5 cm of the littered pasture had a higher percent of the exchange complex saturated with K, higher water soluble P and NO3, and a lower C/N ratio. Plant samples showed increased total N and potentially toxic levels of NO3-N accumulations during summer months in the forage. Perloline levels in fescue varied from a low in early spring and fall (160 micro g/g) to a maximum in August (830 micro g/g). Differential rates of uptake of K/Ca/Mg during early spring resulted in grass having K/Ca + Mg ratios greater than 2.2. Fat necrosis was detected by rectal palpation in 2 of 21 and 7 of 21 cows after 1 and 2 years of study in the broiler littered fescue and none in 1 of 24 in the control herd. (See also W72-09940) (Schmitt-Iowa State) W72-10031

MOVEMENT OF POLLUTANT PHOSPHORUS IN SATURATED SOILS, Purdue Univ., Lafayette, Ind. Dept. of Agricul-

tural Engineering.
For primary bibliographic entry see Field 05B. W72-10032

TREATMENT OF LIVESTOCK-LAGOON EF-FLUENT BY SOIL FILTRATION, Iowa State Univ., Ames. Dept. of Agricultural En-

gineering. For primary bibliographic entry see Field 05D. W72-10033

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

W72-10220

W72-10233

## Water Quality Control—Group 5G

GROWTH RESPONSE OF PLANTS UNDER SPRINKLER IRRIGATION WITH DAIRY WASTE,

Florida Univ., Gainesville. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 05D.

NITROGEN REMOVAL FROM SEWAGE WATERS BY PLANTS AND SOIL, Maryland Univ., College Park. Dept. of Agrono-

W. Larsen, and J. H. Axley.

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In: Livestock Waste Management and Pollution Abatement, Proceedings International Symposium on Livestock Wastes, Ohio State University, April 19-22, 1971, p 338-340, 6 tab, 17 ref.

Descriptors: \*Farm wastes, \*Nutrient removal, \*Soil filters, Denitrification, Nitrogen compounds, Ammonia, Leaching, Sewage disposal, Filtration. Identifiers: Soil filtration.

The addition of 3000 pounds per acre of nitrogen, 50 tons of organic matter and 200 acre inches of water per year to plants and soil was studied in water per year to plants and soli was studied in reference to changes in sewage as it entered the soil and passed through the soil to a depth of 30 feet. At this depth these waters were returned to the surface by pumps. By use of chloride as a tracer, ground water dilution estimates were made and a nitrogen balance sheet for the changes, losses, and destinations of nitrogen throughout the cycle was developed. The 65 ppm of N in sewage, when applied at a rate of 508 cm per year (200 inches per year), was reduced to 11 ppm of NO3-N after the sewage has passed through 3 meters of water unsaturated soil and 6 m of water saturated soil. Denitrification and immobilization of nitrogen were the two most important factors in nitrogen removal when treatment rates were 11.7 to 23.7 cm per week. (See also W72-09940) (Schmitt-Iowa State) W72-10035

RENOVATION AND REUSE OF WATER FOR DILUTION AND HYDRAULIC TRANSPORT OF DAIRY CATTLE MANURE,

Massachusetts Univ., Amherst. Dept. of Food and Agricultural Engineering. For primary bibliographic entry see Field 05D. W72-10036

THE SEPARATION OF SOLID AND LIQUID PARTS OF PIG SLURRY,

Instituut voor Landbouwbedrijfsgebouwen, Wageningen (Netherlands).

Wageningen (Netherlands).

J. C. Glerum, G. Klomp, and H. R. Poelma.

In: Livestock Waste Management and Pollution
Abatement, Proceedings International Symposium
on Livestock Wastes, Ohio State University, April
19-22, 1971, p 345-347, 2 tab, 5 fig.

Descriptors: \*Farm wastes, \*Slurries, \*Separation techniques, Sieve analysis, Sedimentation, Dewatering, Hogs, Waste treatment. Identifiers: Centrisieve, Decanter centrifuge, Vibroscreen, Rotary vacuum filter.

Experiments designed to separate solid and liquid parts of pig slurry were made with a centrisieve, two decanter centrifuges, a rotary vacuum filter, a vibroscreen, and a sedimentation silo. With the aid of a centrisieve between 30 and 40% of the dry matter could be removed from pig slurry with a dry matter content of 5 to 8%. The separated material has a dry matter content of 14 to 19%. High demands are made on the homogenity and supply of the slurry. The material separated by the decanter centrifuge was quite dry, but the energy consumption per unit capacity was very high. The separation capacity of the vacuum filter equaled that of the decanter centrifuge but had a lower energy requirement. The separated material from the vibroscreen continued too wet and the capacity was also low. The sedimentation silo showed

the biggest reduction of the slurry was initially high (15-19%) and the storage time was long. The centrisieve performed best based on results, capacity and initial expense. The sedimentation silo also performed well. (See also W72-09940) (Schmitt-Iowa State) W72-10037

DEWATERING POULTRY MANURE BY CEN-

Kentucky Univ., Lexington. Dept. of Agricultural Engineering.

For primary bibliographic entry see Field 05D. W72-10038

CONCENTRATION OF PROTEINACEOUS SOLIDS FROM OXIDATION DITCH MIXED--LIQUOR.

Illinois Univ., Urbana. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05D. W72-10039

COASTAL WATER QUALITY, Texas Water Quality Board, Austin. For primary bibliographic entry see Field 06D. W72-10050

UNDERSTANDING ENVIRONMENTAL POLLU-

C. V. Mosby Co., Saint Louis, Mo., 1971. M. A. Strobbe, editor. 357 p. Pr. \$5.95.
Identifiers: Environment, \*Pollution, Pollution abatement, Control.

Articles have been selected, compiled and reprinted to furnish substantial support for the study of environmental quality in association with general science, conservation, ecology and biology. The subject matter is divided into 2 major areas. The first part is comprised of articles rela-tive to the major environmental pollution problems and written by persons who have a grasp of the problems but are not involved in scientific or technological research. The variety of opinions provides a cross section of the field. The second part includes research articles dealing with specific problems. The articles support the areas covered in the first part, thus providing evidence of accomplishments and pointing up the necessity of interplay between all professions for the solution of environmental pollution problems. The readings should prove useful for college environmental quality courses of interdisciplinary nature. This may also serve as a handbook and guide to the understanding of the different parameters of environmental pollution control. Five appendixes, a listing of supportive reference, a listing of au-diovisual aids tha: illustrate the effects of various pollutants on the environment, a glossary of terms, and a listing of some national conservation organizations have been included.—Copyright 1972, Biological Abstracts, Inc. W72-10124

COASTAL ZONE MANAGEMENT.

Committee on Public Works (U. S. Senate). Sub-committee on Flood Control - Rivers and Harbors. For primary bibliographic entry see Field 06E.

REGISTRATION OF HERBICIDES FOR AQUATIC USE,

Food and Drug Administration, Rockville, Md. Div. of Food Chemistry and Technology. J. C. Cummings.

Available from the National Technical Informa-tion Service as AD-726 028, \$3.00 in paper copy, \$0.95 in microfiche. Report, Office of the Chief of Engineers, Department of the Army, January

Descriptors: \*Aquatic weed control, \*Herbicides, \*Public health, \*Water quality standards, Pesticides, Pesticide toxicity, Pesticide residues, Fish, Shellfish, Aquatic environment, Potable water, Regulation, Federal government.

Identifiers: "Herbicide registration, "Herbicide toxicity, "Herbicide residues, Food and Drug Administration, Toxicology data.

Toxicology data including 90-day feeding for two species of mammals are required for registration of each aquatic herbicide. Residue data for irrigated crops, meat, poultry, milk and eggs, fish and shellfish, and potable water are also required for each registered use that may affect these areas. (Svensson-Washington) W72-10199

ALDRIN: REMOVAL FROM LAKE WATER BY FLOCCULENT BACTERIA, Ohio State Univ., Columbus. For primary bibliographic entry see Field 05D.

BIOCHEMICAL CHANGES IN OXIDATION Maharaja Sayajirao Univ. of Baroda (India). Dept. of Biochemistry. For primary bibliographic entry see Field 05D.

THE RIVER BASIN MODEL: AN OVERVIEW. Environmetrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06A. W72-10307

THE RIVER BASIN MODEL: UTILITY DE-PARTMENT.

Envirometrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06A. W72-10313

THE RIVER BASIN MODEL: HIGHWAY DE-PARTMENT.

Environmetrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06A. W72-10314

REPLACEMENT OF WATER DISTRIBUTION

American Water Works Association, New York. Task Group 2850D. For primary bibliographic entry see Field 05F. W72-10367

REORIENTATION TO MEET THE CHAL-

LENGE OF QUALITY WATER, American Water Works Association, New York; and Missouri Water Co., Independence.

R. J. Faust, and H. D. Dyer.

Journal of the American Water Works Association, Vol 57, No 6, p677-693, June 1965. 3 fig, 1

Descriptors: \*Water quality control, \*Water management (Applied), \*Administrative decisions, Salaries, Management, Labor supply, Personnel, Training. Identifiers: \*Personnel policies.

A good water system should operate under progressive principles and a sound fiscal policy. The utility operation should be a business based on customer orientation, future orientation, value orientation, profit orientation, and board orienta-tion. Ever increasing numbers of better-educated, highly skilled managers, engineers and technicians must be brought into the water industry. Since the industry is far behind in recruiting such capable people, it should adopt salary and personnel policies that will attract and retain such personnel. Higher qualifications for all personnel must be set

## Group 5G-Water Quality Control

and a better image of the industry can be established by setting higher standards, giving better service, and using public relations more ef-fectively. (Britton-AWWARF) W72-10382

ANALYSIS OF ALKALINE PULPING LIQUOR WITH SULFIDE ION-SELECTIVE ELEC-TRODE.

Foxboro Co., Mass. For primary bibliographic entry see Field 05D. W72-10385

BASIN MANAGEMENT TECHNIQUES FOR

SEWERAGE AGENCIES, Municipality of Metropolitan Seattle, Wash. C. V. Gibbs, and A. L. Poole.

Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 98, No. SA3, June 1972, p 491-504, 11 ref.

Descriptors: \*Sewage systems, \*Land management. \*Riverbasin management, Regional analysis, Planning, Administration, Water utilization, Water quality control, Automatic control, Monitoring, Financing, Waste water treatment.

Identifiers: Seattle (Wash).

Management of sewerage agencies has developed to the point that consideration must be given to any and all factors influencing water quality, and many different basin management practices and techniques will be required in order to do an effective job. Those basin management practices which will be of importance to a sewerage agency include: (1) a dynamic land use plan designed to preserve the natural environment; (2) administrative co-ordination between public and private agencies; (3) comprehensive water quality toring for all basin waterways; (4) water budget planning for the future utilization of basin water resources; (5) computer use for basin development studies, evaluation of technological engineering and economic options and possible automated control of the entire sewerage system; (6) financing methods for controlled basin development; (7) management information systems; and (8) citizen involvement and contribution. The municipality of Metropolitan Seattle has utilized many of these techniques in basin planning and regionalization of pollution abatement and control projects, and Seattle-Metro is presented as a basin management case study. (Lowry-Texas) W72-10415

MEASUREMENT OF TOTAL SOLIDS IN KRAFT BLACK LIQUORS, Kimberly-Clark Corp., Neenah, Wis.

J. L. Parker, R. P. Hensel, and C. L. Wagoner. Tappi, Vol 53, No. 5, May 1970, p 874-877, 27 ref.

Descriptors: \*Pulp and paper industry, \*Kraft mill wastes, \*Analytical techniques, Laboratory tests, Separation techniques, Evaporation, Drying, Suspended solids, Dissolved solids, Moisture, Wastes dilution, Oxidation, Water quality control. Identifiers: Industrial wastes.

The present solids determination procedure for black liquor total solids measurement involves the evaporation of 10 ml of liquor in a tared evaporating dish at 105C for 24 hours. Criticisms of this method include: (1) 'Scum' formed during the process traps an undetermined amount of moisture in the residue; (2) waters of crystallization are not evaporated, yielding high results; (3) residue weight even after 24 hours is not constant, possibly due to continued moisture loss, but also by thermal decomposition and volatilization of organic materials; (4) volatile substances other than water are lost; (5) oxidation may take place in the presence of air, yielding high results; (6) 24 hours is too long for usefulness in evaporator or boiler control; and (7) drying rates vary if oven humidity is uncontrolled. The following modifications to eliminate or minimize problems with the present procedure were suggested: (1) use of surface extenders and dilution of high-solids samples to minimize moisture entrapment; (2) specification of oven size and rate of airflow and use of pre-dried air to increase and standardize drying rate; (3) dilution of high solids liquors to a concentration which can be handled as a liquor, with provisions made to allow use of the sample for other analyses such as heating value or chemical analysis. Possible additional problems are suggested, however, that should be evaluated for significance. (Lowry-Texas) W72-10419

KRAFT PULPING,

North Carolina State Univ., Raleigh.

P. J. Kleppe. Tappi, Vol 53, No. 1, January 1970, p 35-47, 11 fig, tab. 115 ref.

Descriptors: \*Pulp and paper industry, \*Kraft mill wastes, Sulfur compounds, Chemical reactions, Sulfite liquor, Lignins, Odors, Color, Digestion, Temperature, Hydrogen ion concentration, Incineration, Oxidation, Chemical precipitation, Waste water treatment, Industrial wastes.

Kraft pulping, now nearly predominant in the paper industry, has become increasingly popular for the following reasons: (1) pulping chemicals can be efficiently and economically recovered; (2) all commercially available woods can be pulped by the process; (3) the discovery of chlorine dioxide as a pulp bleaching agent, and methods to produce it cheaply and to use it very efficiently in the bleaching of kraft pulps; and (4) paper and board products produced from kraft pulps are generally superior in strength compared to products produced from other pulps. A literature review of several pulping variables on delignification rate, pulp yield, and pulp properties was conducted and the results are presented. New developments in both process control and pollution control are also presented. Present trends indicate that the kraft process will be the dominant pulping process for at least the next 20 years, while the trends toward continuous, closed cycle processes advances and refinements to this concept are continually made. (Lowry-Texas) W72-10420

ECONOMICS OF WATER QUALITY AND WASTEWATER CONTROL.

California Univ., Los Angeles. Graduate School of Management. F. E. Case.

Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol. 98, No. SA2, p 427-434, April, 1972.

Descriptors: \*Water utilization, \*Waste water disposal, \*Economic efficiency, Economic impact, Cost-benefit analysis, Regulation.
Identifiers: \*Externalities, Social costs, Private

In the past, water was treated as a 'free' good. However, population increases and technological changes have increased the demand for water to the extent that it is now one of our scarcest natural resources. As an economic good, water is valuable in creating other goods, as a natural force for producing energy, or as an agent for improving the quality of living and the environment. Unfortunately, the private marketplace tends to under-price water. The optimizing individual or firm uses water and creates wastewater without regard for those social costs not included in the price of water. This market failure provides a rationale for public intervention which may take such forms as regulations or tax-subsidy schemes. Water production must include consideration of wastewater disposal problems so that private profits may be maintained without creating undue social costs and so that optimal uses may be made of the water. Economic efficiency would require that water and wastewater management be treated in terms of a system. That is, a system using water and wastewater must provide ways by which water can be fed back into the system. (Settle-Wisconsin) ture in t

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## 06. WATER RESOURCES PLANNING

## 6A. Techniques of Planning

AN OUTDOOR RECREATION PLAN FOR WYOMING.

Wyoming Recreation Commission, Cheyenne. For primary bibliographic entry see Field 06B. W72-10055

URBAN WATER RESOURCES PLANNING AND

MANAGEMENT. Texas A and M Univ., College Station. Water Resources Inst.

Available from the National Technical Information Service as PB-210 325, \$3.00 in paper copy, \$0.95 in microfiche. Proceedings of the 16th Annual Conference on Water for Texas, 'Urban Water Resources Planning and Management', San Antonio, Texas, September 9-10, 1971. Texas Water Resources Institute, Austin, 200 p. Project No. OWRR A-999-TEX (5).

Descriptors: \*City planning, \*Urbanization, \*Water resources development, \*Planning, \*Management, \*Systems analysis, Water supply, Groundwater, Conjunctive use, Urban runoff, Flood plains, Social aspects, Economic impact, Recreation, Environment, Cost analysis, Recycling, Water quality, Simulation-analysis, Comprehensive planning, River basins, Interagency cooperation, Texas, Water reuse.

Identifiers: \*Urban water management, Hydrometeorology, Environmental enhancement.

The theme of the 16th Annual Conference on Water for Texas was urban water resources planning and management. Among the topics discussed are: perspectives in urban water management, systems description for urban water resources, conjunctive use of surface and ground water in urban water supplies, hydrometeorology for urban runoff systems, flood plain planning in urban areas, socio-economic aspects of urban water planning, environmental enhancement and recreation, costs of water reuse, river basin quality simulation. Bureau of Reclamation programs related to urban water resources and comprehensive inter-basin planning and inter-governmental coordination. Most papers use examples in Texas, especially the San Antonio area. (See also W72-10101 thru W72-10111) (Davis-Chicago)

HYDROMETEOROLOGY FOR URBAN RU-NOFF SYSTEMS

Texas A and M Univ., College Station. Dept. of Meteorology.

R. A. Clark In: Proceedings of the 16th Annual Conference on

Water for Texas, 'Urban Water Resources Planning and Management', San Antonio, Texas. September 9-10 1971, Texas Water Resources Institute, p 59-72, 9 fig, 9 ref.

Descriptors: \*Urban runoff, \*Runoff, \*Urbanization, \*Meteorology, \*Urban hydrology, \*Microclimatology, \*Micrometeorology, Temperature, Runoff forecasting, Rainfall disposition, Air pollution effects, Flood control. Identifiers: \*Hydrometeorology, Heat island ef-

fect, \*Urban water management.

Various implications of hydrometeorology in an urban context are discussed, specifically the modifications to our climate and changes in the runoff regime due to urbanization. First, temperawastecan be

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ture is clearly affected by urbanization, resulting in the microclimatic 'heat island' effect. Second, there are indications that rainfall is increased by industrial pollution resulting in higher rainfalls downward from urbanized areas. Third, urbanizagownard from treatment and the states of trunoff and higher flood peaks creating increased flood control problems. (See also W72-10100) (Davis-Chicago) W72-10104

RIVER BASIN QUALITY SIMULATION,

RIVER BASIN QUALITY SIMULATION,
Texas Water Development Board, Austin.
W. A. White, and L. F. Tischler.
In: Proceedings of the 16th Annual Conference on
Water for Texas, 'Urban Water Resources
Planning and Management', San Antonio, Texas,
September 9-10, 1971, Texas Water Resources Institute, p 155-175, 6 fig, 9 ref.

Descriptors: \*River basins, \*Simulation analysis, \*Mathematical models, \*Model studies, \*Water resources, \*Water quality, Waste assimilative capacity, Biochemical oxygen demand, Planning, Dissolved solids, Dissolved oxygen, Temperature, Hydrology, Comprehensive planning, River basin development.
Identifiers: \*Comprehensive water resources plan,

Dissolved inorganics.

The capability of routing a given water quality parameter through a stream or canal system and estimating with reasonable accuracy the waste-assimilative capacity of the system is essential to any comprehensive water resources plan. The degree of resolution required to determine the response of a stream or canal system to any water quality management concept is a very difficult problem. A stream is a conglomerate of complex biological, chemical, physical, and hydraulic factors. To determine the combined effect of these various factors, mathematical models capable of representing some of the more important inter-relationships between the variables have been developed. A mathematical model of stream or canal system consists of a series of elements, each corresponding to a discrete stream or canal seg-ment, arranged so that the output from one element becomes the input of the next. The transfer function is determined by performing a mass balance of a given water quality parameter over a time interval, on a stream or canal segment of a cross sectional area and of given lengths along the x-axis. The primary objective of this modeling efreality models capable of routing the following water quality models capable of routing the following water quality parameters through a stream subsystem: (1) temperature (2) biochemical oxygen demand and dissolved oxygen, and (3) conservative minerals. (See also W72-10100) (Davis-Chicago) W72-10109

COASTAL ZONE MANAGEMENT. Committee on Public Works (U. S. Senate). Sub-committee on Flood Control - Rivers and Harbors. For primary bibliographic entry see Field 06E. W72-10194

ANALYSIS OF RESIDUAL HYDROLOGIC STOCHASTIC PROCESSES, Illinois Univ., Urbana. Dept. of Civil Engineering.

For primary bibliographic entry see Field 02A.

A STOCHASTIC MODEL OF RUNOFF-PRODUCING RAINFALL FOR SUMMER TYPE STORMS, Arizona Univ., Tucson.
L. Duckstein, M. M. Fogel, and C. C. Kisiel.
Water Resources Research, Vol 8, No 2, p 410-421, April 1972. 5 fig, 1 tab, 20 ref. OWRR A-020-ARIZ (5).

Descriptors: \*Statistical models, \*Stochastic processes, \*Rainfall disposition, \*Precipitation (Atmospheric), \*Variability, Time series analysis, Synthetic hydrology, Rainfall-runoff relationships, Mathematical models, Runoff forecasting, Simulation analysis, Water yield, Urban hydrology, Urbanization, Land use.

In calculating runoff from modified watersheds, the rainfall input must be properly modeled before the runoff output can be predicted. Runoff-producing summer precipitation of short duration and high spatial variability are considered as an in-termittent stochastic phenomenom. The probability distribution of seasonal total point or areal rainfall is obtained by convoluting a Poisson number ran is obtained by convoluting a Poisson number of events with a geometric or negative binomial probability of rainfall amount. The probability of various combinations of rainfall amounts, given the seasonal total and the number of events, is computed. With these results, the theoretical seasonal water yield distribution can be obtained by using a simple rainfall-runoff relationship, such as the Soil Conservation Service formula. The possibility of using regional input parameters to study the distribution of the output of poorly gaged small watersheds is discussed. In particular, extreme total flows can be computed. (Knapp-USGS)

MODELING THE PORE STRUCTURE OF

POROUS MEDIA,
Agricultural Research Service, St. Paul, Minn. Soil
and Water Conservation Research Div.
For primary bibliographic entry see Field 02F.
W72-10276

SENSITIVITY OF RESERVOIR DESIGN TO THE GENERATING MECHANISM OF IN-

Thomas J. Watson Research Center, Yorktown Heights, N.Y. J. R. Wallis, and N. C. Matalas. Water Resources Research, Vol 8, No 3, p 634-641, June 1972. 7 fig, 3 tab, 7 ref.

Descriptors: \*Statistical methods, \*Reservoir design, \*Simulation analysis, \*Reservoir operation, \*Water balance, Water management (Applied), Synthetic hydrology, Correlation analysis, Water demand, Stochastic processes, Variability, Probability, Markov processes. Identifiers: Hurst coefficient.

The design capacity of a reservoir depends on the generating mechanism of the inflows. If the sequent peak algorithm is used in a deterministic manner, the minimum capacity required to meet a specified level of demand depends on demand and the values of the lag I serial correlation coefficient and the Hurst coefficient of the inflows. Although these experimental results may not realistically describe the ranges of the values over which other objective functions are sensitive to the flow-generating model, they do indicate that such ranges exist and that both the list of moments to preserve and the means for their unbiased preservation must be considered. (Knapp-USGS) W72-10279

DIGITAL SIMULATION OF THE BOUSSINESQ EQUATION FOR A WATER TABLE AQUIFER, Nova Scotia Dept. of Mines, Halifax. For primary bibliographic entry see Field 02F. W72-10281

DIGITAL COMPUTER SIMULATION FOR SOLVING MANAGEMENT PROBLEMS OF CONJUNCTIVE GROUNDWATER AND SURFACE WATER SYSTEMS, Resources for the Future, Inc., Washington, D.C.

For primary bibliographic entry see Field 04B.

THE RIVER BASIN MODEL: AN OVERVIEW. Environmetrics, Inc., Washington, D.C.

Copy available from GPO Sup Doc, \$1.00; microfiche from NTIS as PB-210 409, \$0.95. En-vironmental Protection Agency, Water Pollution Control Research Series, December 1971. 109 p, 34 fig, 27 ref, 6 append. EPA Program 16110 FRU 12/71-1.

Descriptors: \*Regional analysis, \*Resource alloca-tion, \*Decision making, \*Simulation analysis, \*Computer programs, \*Mathematical models, \*Land use, \*Water users, \*Water demand, \*Train-ing, \*Water pollution, \*Effects, \*Treatment, \*Population, Migration, Water disposal. Identifiers: \*Social dissatisfaction, \*Gaming-simu-lation, \*Hollistic models.

lation. Holistic models.

The RIVER BASIN MODEL is a man-machine simulation model, used primarily to replicate the interactions taking place, within a real or hypothetical area, between the local water system and the full range of economic, social, and governmental activities of that area. It is a water resource model representing supply of, demand for, and quality of water, but it is also a labor market model, a land use and assessment model, and several more; it is a model of an entire regional several more; it is a model of an entire regional system with water a subsystem realistically interacting with all the other major subsystems; the output from the operating programs of the computer package illustrate the impact that the water system has on such phenomena as housing selection, employment, and government budgetary activity. Model users are given control over all the resources of the local area being represented. Most of the local business and population use municipally supplied water which must be drawn from the local water system and treated if necessary. The model users may make a wide range of ry. The model users may make a wide range of private and public policy decisions which affect the simulations for each of the above phenomena, and which impact the environmental quality of the represented area. (Bell-Cornell)
W72-10307

THE RIVER BASIN MODEL: UTILITY DE-PARTMENT.

Envirometrics, Inc., Washington, D.C.

Copy available from GPO Sup Doc EPA 210.:16110 FRU 12-71-9, \$1.25; microfiche from NTIS as PB-210 410, \$0.95. Environmental Protec-tion Agency Water Pollution Control Research Se-ries, December, 1971. 129 p, 38 fig, 10 tab, 1 ap-pend.EPA Program 16110 FRU 12/71-9

Descriptors: "Regional analysis, "Decision making," Simulation analysis, "Computer programs, "Mathematical models, "Public utilities, "Municipal water, "Water allocation (Policy), "Water demand, "Water users, "Water pollution control,

Treatment.

Identifiers: \*Sewer services, \*Governmental processes, \*Public policy, \*Public services, \*Gamng-simulation

The River Basin Model replicates interactions taking place between the local water system and the full range of regional activities within a real or hypothetical area. It is a man-machine simulation model using a gaming format; it is a model of an entire regional system with water a subsystem realistically interacting with the other major subsystems. The model is a computer assisted decision, making tool providing represents to which subsystems. The model is a computer assisted decision-making tool providing programs to which its users present inputs on behalf of business activities in the Economic Sector, groups of people or population units in the Social Sector, and government departments in the Governmental Sector. The Governmental Sector and the model Sector: The Governmental Sector and the moder required by its Utility Department are described. A principal function of the Governmental Sector is to provide public services, and its participants are elected and appointed public officials. The Utility and water and sewer services which economic ac-

## Field 06-WATER RESOURCES PLANNING

## Group 6A-Techniques of Planning

tivities require in order to operate. The Department's utility operations are separate from its water and sewer operations but both are funded from the Department's general budget. (Bell-Cor-W72-10313

THE RIVER BASIN MODEL: HIGHWAY DE-

Environmetrics, Inc., Washington, D.C.

Copy available from GPO Sup Doc EPA 2.10:16110 FRU-12-71-10, \$1.00; microfiche from NTIS as PB-210 411, \$0.95. Environmental Protection Agency Water Pollution Control Research Series December, 1971. 104 p, 27 fig, 4 tab, 4 append. EPA Program 16110 FRU 12/71-10.

Descriptors: \*Regional analysis, \*Simulation analysis, \*Computer programs, \*Decision making, \*Transportation, \*Highways, \*Mathematical models, \*Water demand, \*Water users, \*Water pollution control, \*Treatment.

Identifiers: \*Governmental processes, \*Public policy, \*Public services, \*Gaming-simulation.

The River Basin Model is not primarily a water management model. Through human interaction and computer simulation, it and its users represent the major economic, social, and governmental decision-making which causes a regional system to function and change on a year-to-year basis. As part of the functioning of this system, water is de-manded by industries and municipal water suppliers and pollution is generated by manufacturing and commercial activities, by people, and by farm activities. A gaming format is employed; model users provide inputs to the computer programs on behalf of business activities in the Economic Sector, groups of people or population units in the Social Sector, and government departments in the Governmental Sector. The Governmental Sector and the model required by its Highway Department are described. A principal function of the Governmental Sector is to provide public services, and its participants are elected and appointed public officials. The Highway Department has the responsibility for two types of transportation deciresponsibility of two types of transportation deci-sion-making: Building and maintaining the highway system within the jurisdiction; and build-ing transportation terminals to be used by local business for shipping and receiving. (Bell-Cornell)

THE UNCERTAIN SEARCH FOR ENVIRON-MENTAL POLICY: SCIENTIFIC FACTFIND-ING AND RATIONAL DECISIONMAKING ALONG THE DELAWARE RIVER,

Pennsylvania Univ., Philadelphia. School of Law. B. Ackerman, and J. Sawyer. University of Pennsylvania Law Review, Vol. 120,

No. 3, January, 1972, p 419-503. 6 fig, 4 tab, 89 ref.

Descriptors: \*Water quality control, \*Pollutants, \*Mathematical models, \*Decision making, \*Delaware River, \*Delaware River Basin Commission, Dissolved oxygen, Biochemical oxygen demand. Economics, Political aspects, Common law.

The Delaware Estuary Comprehensive Survey (DECS) has attempted to quantify costs and benefits of embarking upon a variety of anti-pollution programs under consideration of the Delaware River Basin Commission. Sound policymaking requires a sophisticated understanding of the factual context, for choosing appropriate models and ultimately deriving economically optimal alternatives. The DECS model is based on a materials balance analysis of a hypothetical segment of the river. Repeating the same analysis for a large number of sections of the river results in a set of simultaneous differential equations. Both DO and BOD concentrations are modeled for each section of the river. A massively documented, rigorous examination is presented of the Survey's sources of error, both in terms of data used and in the structure of the mathematical model itself, which produced an unreliable pollution control model that was relied upon by decision makers unable to understand either its complexities or limitations. (Bell-Cornell) W72-10315

MODELS FOR DETERMINING LEAST-COST INVESTMENTS IN ELECTRICITY SUPPLY,
International Bank for Reconstruction
Development, Washington, D.C.

The Bell Journal of Economics and Management Science, Vol. 3, No. 1, Spring, 1972, p 267-299. 8

Descriptors: \*Mathematical models, \*Optimiza-tion, \*Electric power industry, \*Decision making, \*Systems analysis, \*Prices, \*Costs. Identifiers: \*Electrical energy transport.

Models used in the electricity supply industry for appraising investments are reviewed and some extentions are presented. The investment decision variables of the industry interact strongly at a point in time and over time. This occurs for a number of reasons perhaps best explained through two examples: Different energy sources have complementary functions in modern interconnected power systems; the optimum balance will depend on both the inherited and the expected structure of the power system. Quantities de-manded and the prices of inputs and outputs are assumed to be exogenous, and the models search for investments having the lowest costs. Optimization is over several time periods. Typical decision variables considered are: choice of fossil, nuclear, single or multi-purpose hydro plant; locations of plants; directions of electrical energy transport (in-terconnection); timing of investments; replacement; and in all cases the optimum mode of system operation (including hydro storage policy). These variables may be analyzed by linear, non-linear, and dynamic programming as well as other methods. Both global models and optimization treatment of subproblems are reviewed. (Bell-Cor-W72-10316

AN ALLOCATION MODEL TO DETERMINE AGRICULTURE'S ABILITY TO COMPETE FOR WATER,

Florida Univ., Gainesville. Dept. of Agricultural Economics.
J. E. Reynolds, and J. R. Connor.

Florida Agricultural Experiment Station Journal,

Series No. 4245. 1971. 14 p, 14 ref.

Descriptors: \*Water allocation (Policy), \*Water management (Applied), \*Water distribution (Applied), \*Water demand, \*Model studies, \*Systems analysis, Economics, Decision making

The distribution of existing or potential supplies of water among competing uses may involve many important decisions affecting the development and use of water resources. Presented is an economic allocation model which provides criteria for allocating water among alternative uses. The model assumes the prevailing goal of society is economic and that production functions for all products can be estimated, assumptions which may not always relate to real world situations. Some problems of empirical application of the model are discussed such as the need to develop accurate production functions; more research is needed in terms of estimating marginal value productivities of water at levels of use other than those which are optimal for the firm or production unit. Extensions of the model are explored to handle other problems such as water quality, varying demands for water at dif-ferent times of the year, and physical and institu-tional constraints upon economically efficient water allocation. These model extensions help to illustrate problems specific to agricultural uses and identify needed research. Despite data limitations, the general nature of the production response to water can be approximated from available data,

providing useful guidelines for making water allocation decisions. (Bell-Cornell) W72-10317

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CLASSIFYING WATER BODIES,

Colorado State Univ., Fort Collins. Dept. of Recreation Resources. R. Aukerman, and G. I. Chesley.

Available from the National Technical Informa-tion Service as PB-208 667, \$5.45 in paper copy, \$0.95 in microfiche. National Water Commission Report No. NWC-EES-72-040, Jul 1971. 123 p. NWC 70-034.

Descriptors: \*Planning, \*Water resources development, \*Water utilization, \*Water allocation (Policy), River basin development, Decision making, Multiple-purpose projects, Land classifi-cation, Optimization, Optimum development Identifiers: \*Water classification.

The feasibility of classifying water bodies and segments thereof by potential use, and the desirability of designating certain water for specific use or uses were examined. Evidence indicates a definite need for water classification. Criteria for a useful water classification system are identified and existing natural resource classification systems are evaluated. Weaknesses of predetermined catego-ries and limited purpose classifications are explored. Satisfactory classification by potential optimum use requires a comprehensive planning process which identifies conflicts and is basically a decision system. The five stages of the system are outlined in detail. Professionals who would be developing and using the system were asked to review it; their comments are summarized. Appendices contain definitions, factors critical to specific water uses, related literature and methodology. (NWC)
W72-10321

ALLOCATION IN SPACE AND ENVIRONMEN-TAL POLLUTION,

Oslo Univ. (Norway).

F. R. Forsund. Swedish Journal of Economics, Vol. 74, No. 1, p 19-34, 1972. 11 ref.

Descriptors: \*Environment, \*Pollutants, \*Mathematical models, Optimization, Economic efficiency, Public benefits.

Environmental pollution due to the generation of residuals is analyzed in a general equilibrium model for allocation in space. The residuals are material residuals that take the form of solids. liquids, or gases, and energy residuals manifested as heat and noise. Only the allocation problems of flow magnitudes are considered; the dynamic problems of environmental pollution such as negative effects from stocks of accumulated persistent materials are ignored. A Pareto-efficient allocation can be found from the model by maximizing the positively weighted vector sum of the individual utility functions. These functions have as arg ments a consumption vector for private market goods and a vector of environmental public goods. The following are constraints on the proble the demand of private goods cannot exceed the supply; (2) the demand for transport cannot exceed the supply of transport services; (3) output must be feasible in every market; and (4) factor supplies are fixed. Manipulation of the necessary ditions gives us 'the Gossen law of residual disposal': a residual must be distributed to the recipients such that the marginal social damage of using the inventory services of the recipients is equal for all recipients. (Settle-Wisconsin) W72-10423

COST-BENEFIT ANALYSIS FOR RESOURCE PLANNING IN ONTARIO, D. J. Clough.

In: Cost Benefit Analysis, A Symposium held in the Hague, July, 1969, The English Universities Press, Ltd., London, 1971, M.G. Kendall, editor, p. 237-251. 2 tab, 35 ref.

Descriptors: \*Cost-benefit analysis, \*Water resources development, \*Measurement, Value, Tangible benefits, River systems, Canada.

The application of cost-benefit analysis to river system planning is circumscribed by four important conditions. First, water resource development projects are financed by federal, provincial, and municipal governments. Consequently, the projects are administered by a number of government departments, with each espousing its own objectives and policies. Second, various nongovernmental groups enter into the decision-making process. Third, existing theories and models for the measurement of economic values are inadequate. Nevertheless, they are necessary expedients for decision-making. Fourth, few professional analysts have enough broad professional competence to integrate and assess the contributions of all the disciplines involved with any project. The problems these four constraints pose for cost-benefit analysis are discussed within the framework of river system planning in Ontario, Canada. Topics include primitive variables, which consist of decision variables and response variables; measures of value; and transformation models including flood control and pollution abatement sub-models. (Settle-Wisconsin) W72-10427

POLLUTION IN A CRUSOE ECONOMY, Iowa State Univ., Ames.

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The Canadian Journal of Economics, Vol. 5, No. 1, p. 110-118, February, 1972. 6 fig.

Descriptors: \*Pollutants, \*Mathematical models, Pollution taxes (Charges).

Identifiers: Competitive equilibrium, Pareto optimality, Optimality.

A Robinson Crusoe economy is used to analyze the pollution effects of production. In this simple model, Robinson allocates his time between work and leisure, and all work consists of producing a single, non-storable commodity. If Robinson acts as a dictator or producer-consumer unit, the pollution problem is internalized. However, if the decision-making process is decentralized, the competitive mechanism leads to a sub-optimal allocation of resources; that is, there is too much output and too little leisure. Multiple equilibria are possible if additional pollution lowers the marginal disutility of work relative to the marginal utility of consumption. If multiple solutions exist, the lowest level production solution will both be stable. Thus, upward shocks may push the economy from the low-level equilibrium to a lower level of welfare, while downward shocks may have the opposite effect. A suitable tax-subsidy scheme would again equate the Pareto optimum with the competitive equilibrium. Within this model, these results are independent of who pays the tax, provided the consumers are given the lump-sum subsidy. (Settle-Wisconsin) W72-10428

DEVELOPMENT OF A STATE WATER PLANNING MODEL.-PART II-PERIPHERAL MODELS OF THE YELLOWSTONE BASIN, Montana State Univ., Bozeman. Water Resources

Research Center.
D. W. Boya, and T. T. Williams.

D. W. Boyd, and T. T. Williams.
Available from the National Technical Information Service as PB-210 521, \$3.00 in paper copy,
\$0.95 in microfiche. Montana Water Resources
Research Center, Report No. 26, April 1972. 119 p,
5 fig, 15 append. Project No. OWRR B-029-MONT
(3).

Descriptors: \*Water resources development, \*Operations research, \*Programming, \*Computer models, \*Mathematical models, Montana, Model studies, Planning.

Expertise from the fields of hydrology and operations research is combined to produce a 'State Water-Planning Model'. Begun in September 1968, completion is scheduled for September 1972. The mathematical model, intended for solution by digital computer, is being designed for the Water Resources Division of the State of Montana Department of Natural Resources and Conservation. The model, operated in combination with a computerized data bank, will provide a system which can be interrogated to determine quickly and accurately the likely effects of proposed changes in management practices on the State's water regime. The methodology was formulated and illustrated in, 'Development of a State Water Planning Model, Part I, Methodology', Montana University Joint Water Resources Research Center, Report No. 15 (See W71-10641). A correlation model, balance model and a peripheral model-developed for the entire State for an annual time unit constituted the first phase. The expansion and application of the methodology to that portion of the Yellowstone River Basin which lies within the State of Montana are described in Part II. An annual model, seasonal model and monthly model-developed for the entire Yellowstone Basin-constitutes the second phase. W72-10435

## **6B. Evaluation Process**

COASTAL LAND RESOURCES.

Available from the National Technical Information Service as COM-71-00726, \$3.00 in paper copy, \$0.95 in microfiche. Proceedings of conference June 16-17, 1970, Galveston, Texas Agricultural Extension Service and Texas A and M Univ. Sea Grant Program TAMU-SG-71-101, September 1970, 111 p.

Descriptors: \*Coasts, \*Texas, Shrimp, Industries, Cattle, Recreation, Water utilization, Resources development, Estuaries, Catfishes, Economics.

Activities, problems and opportunities associated with the Texas coastal areas are described by scientists and government specialists. Land utilization, commercial fisheries, industrial development, agriculture and recreation are some of the topics discussed. (See W72-10041 thru W72-10054) W72-10040

A PERSPECTIVE OF COASTAL LAND UTILIZATION, Texas A and M Univ., College Station. Agricul-

Texas A and M Univ., College Station. Agricultural Extension Service.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p 6-11.

Descriptors: \*Coasts, \*Marine animals, \*Research priorities, Coastal marshes, Pollutants, Land development.

The Texas Agricultural Extension Service is involved in carrying out the Extension and Advisory Function of the total Sea Grant Program of Texas A and M University. The primary objective of the Sea Grant Extension and Advisory Program is the interpretation and dissemination of research findings to own..s, managers, and users of maritime resources. The Program has determined that there are several potential opportunities for economic utilization of resources along the Texas Gulf Coast including (1) commercial production of marine species; (2) development of beaches and associated lands and waters; (3) habitat maintenance and improvement of coastal marshes; and

(4) provision of special technical informational services for training and educational programs. One of the basic tenets in Cooperative Extension work is to involve local people in helping to identify the problems that the Extension Service's educational programs should focus on. These people made the following suggestion: (1) the effects of shrimping on juvenile shrimp populations should be attudied; (2) the effects of land filling on crustacean habitat should be examined; and (3) techniques for protecting people from contaminated sea foods need to be developed. (See also W72-10040) (Settle-Wisconsin) W72-100402

SHRIMP MARICULTURE AT THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY.

Bureau of Commercial Fisheries, Galveston, Tex. Biological Lab. C. R. Mock.

In: Proceed. 28 of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p 13-21. 1 fig. 3 tab. 2 ref.

Descriptors: \*Shrimp, \*Shellfish farming, \*Stocking, \*Baits, Demand, Profit, Commercial shellfish.

Recent research indicates that (1) each 1% gain in per capita real income tends to be accompanied by a 1.8% increase in per capital shrimp consumption, and (2) each 1% increase, ceteris paribus, in the retail price of shrimp is accompanied by a 0.5% decline in per capital consumption. With these data it is possible to predict with some reliability what demand and consumption are likely to be in the future. If production increases as anticipated, the total world catch should increase from its current 1 billion pounds to 1.9 billion pounds by the late 1970's. While the technology for shrimp farming has not yet been developed, the expected rapid growth in the demand for shrimp suggests the possibility of commercial activity in some phases of shrimp culture in the near future. The first profitable commercial operations will probably be the culture of shrimp for the live bait markets. The second probable commercial application of shrimp-rearing knowledge will involve stocking of artificially-reared shrimp in natural waters. The third area of commercial development will probably be that of farming shrimp in ponds for sale as food, although several problems remain to be solved before this is feasible. (See also W72-10040) (Settle-Wisconsin)

SHRIMP FARMING-TEXAS STYLE,

Texas Agricultural Extension Service, College Station.

J. Parke

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p 22-26.

Descriptors: \*Shrimp, \*Shellfish farming, \*Farm ponds, \*Economic feasibility, Experimental farms, Texas, Commercial shellfish, Stocking.

Shrimp farming may have a future in Texas. The state has 200,000 acres of coastal lowlands and marshes which are especially suited for pond culture because of the high clay content in the soil. Research has indicated that enough shrimp can be raised in ponds of this type for commercial production. However, pond construction costs and harvest techniques have, in the past, hindered production. Programs are presently under way to attack these problems and evaluate stocking rates and food supplements. All three of the shrimp species harvested commercially on the Texas coast have farming potential. These shrimp are brown shrimp, Panaeus aztecus; white shrimp, Panaeus setiferus; and pink shrimp, Panaeus duorarum.

## Field 06-WATER RESOURCES PLANNING

## **Group 6B—Evaluation Process**

Research with brown and white shrimp indicate that it is necessary to remove all shrimp predators before stocking the ponds. These organisms not only prey on the shrimp but also compete with them for food. Predators can be removed easily with rotenone at a concentration of 2 parts per mil lion. Experiments were undertaken to evaluate the desirability of fish meal as a protein source in artificial shrimp foods; however, these experiments were inconclusive. (See also W72-10040) (Settle-Wisconsin) W72-10044

WATERFOWL MANAGEMENT AND HAR-

VESTING, Chambers County, Anahuac, Tex. For primary bibliographic entry see Field 04C. W72-10045

COASTAL MOSQUITO CONTROL,

Brazoria County Mosquito Control District, Angleton, Tex. J. C. McNeill, IV.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p 32-38. 2

Descriptors: \*Mosquitoes, \*Insect control, \*Insecticides, Safety, Pollutants, Texas, Control,

Most mosquito control districts in Texas are doing adulticiding in response to public demands. When the general public establishes a mosquito control district, they expect to see immediate results, and this can be obtained only by adulticiding. Most of the districts do some limited amount of larviciding, but very little permanent control. Programs aimed at killing adult mosquitoes should utilize organic phosphorus insecticides. Chylorinated hydrocarbon materials should not be used. In all adulticiding operations, extreme precautions must be taken to avoid hitting non-target organisms. As a general rule, programs aimed at killing larvae should not utilize materials employed as adulticides. While certain organic phosphates may be used for larval control, they should only be used in situations where petroleum hydrocarbons are not practical. Materials recommended for larviciding include Materials recommended for inviviting metudo No. 2 diesel oil with a biodegradable spreading agent, FLIT MLO, Abate, Baytex, and Dursban. Materials recommended for adulticiding include Baytex, Malathion, and Ortho Dibrom-14. The Texas Mosquito Control Association's 'Statement of Policy' and its 'Recommended Procedures of Chemical Control of Mosquitoes in Texas' are discussed in an appendix. (See also W72-10040) (Settle-Wisconsin)

COASTAL INDUSTRIAL DEVELOPMENT, Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 05C. W72-10047

BEEF CATTLE PRODUCTION ALONG THE

GULF COAST, Texas A and M Univ., Angleton. Agricultural Research Station.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p 44-48.

Descriptors: \*Cattle, \*Productivity, \*Grazing, Forage grasses, Forage legumes, Ranges, Marshes, Texas.

Beef cattle production on the Gulf Prairie is expected to increase sharply in the near future. Much of this increase will come from increased production per cow. Consequently, an increase in produc-

tivity will depend heavily on clearly understanding the nutrient requirement of the beef cow and developing pasture and feed resources to meet these requirements. The feed requirements will probably be met with highly productive, well-fertilized pastures of adapted grasses and legumes. Other important elements in the development program are systematic crossbreeding programs and good disease and parasite control. Progress in beef cattle production on the native marsh ranges will be much slower. The level of forage production on these ranges is generally low. Furthermore, it is difficult to breed cows nursing calves on these marsh ranges primarily because of insufficient levels of digestible energy in the forage to meet the need of the cows to produce milk, provide for growth of the young cows, and allow these cows to cycle. Also, the phosphorus content of the native forage is generally inadequate to meet the needs of grazing cattle. (See also W72-10040) (Settle-Wisconsin) W72-10048

ECONOMIC IMPACT OF RECREATION--WHO

GETS WHAT, Texas A and M Univ., College Station. Dept. of Agricultural Economics. I. W. Schmedemann.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. a Grant Program, September, 1970, p. 49-60. 3

Descriptors: \*Recreation, \*Economic impact, Recreation facilities, Recreation demand, Texas,

Expenditures. Identifiers: \*Multiplier analysis.

To assist in analyzing the incidence of recreation expenditures it is assumed that recreation consumers can be classified into four demand groups based on their investment and expenditure pat-terns for recreation goods and services. 'Investments' refer to purchases of items such as equip-ment and real estate. 'Expenditures' refer to purchases of items like food, beverages, gasoline, lodging, and bait. The four demand classifications are (1) high investment-low expenditure; (2) high investment-high expenditure; (3) high expenditurelow investment; and (4) low investment-low expenditure. Much of the recreation participation in the Texas coastal areas is derived from the high investment low expenditure group. The average daily expenditure in Texas per tourist was only \$7.85 in 1967; the comparable average in Florida was \$15.76. The study suggests that the economic impact of recreation on a community or area will, for the most part, depend on the degree of business or economic integration characterizing its economy. Apparently, the major portion of the economic benefits from recreation expenditures will accrue to the highly integrated economies of the larger metropolitan centers. Expenditures in small communities have less impact because of a greater tendency for the expenditure to leak out of the community. (See also W72-10040) (Settle-Wisconsin) W72-10049

THE COASTAL RESOURCES MANAGEMENT PROGRAM OF TEXAS,

Office of Natural Resources, Austin, Tex. J. T. Goodwin.

In: Proceedings of the Coastal Land Resources Conference, June 16-17 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p. 71-75.

Descriptors: \*Coasts, \*Resources development, \*Natural resources, Environment, Conservation, Planning, Texas. Identifiers: \*Coastal region.

The Texas Governor's Office recently embarked upon the development of a Coastal Resources Management Program under the direction of the Texas Natural Resources Council. The objective of the resources management program is to deter-mine that environment which will enable man to live in dignity with himself and the rest of nature. The program seeks a balanced environment which (1) provide protection for those resources which must be preserved, (2) use wisely those resources which should be conserved, and (3) develop in an orderly manner those resources which man requires for his industrial, commercial, and urban needs. Texas is particularly fortuniate in and uroan needs. Lexas is particularly fortuniate in that many of its coastal regions remain un-developed. Consequently, these areas can be preserved for future generations and for the main-tenance of species of flora and fauna that give the Texas coast its unique scientific and social value. The program has identified 21 task areas for study which are separate subjects but whose linkages with and impact upon the other task areas would represent the complex interactions of the coastal zone. These task areas were assigned to task forces charged with identifying and describing the applicable coastal resource and alternative uses of the resource. (See also W72-10040) (Settle-W72-10051

THE CAGED CULTURE OF CHANNEL CAT-

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Texas A and M Univ., College Station. Agricultural Extension Service. H. R. Schmittou.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p. 104-111.

Descriptors: \*Catfishes, \*Farm ponds, Commercaial fish, Benefits, Feeds, Diseases. Identifiers: \*Cage cultures.

Raising catfish in cages is a relatively new system for feeding out fingerling catfish to food-fish size. In practice, fingerlings are stocked in early spring in suspended cages, and nutritionally complete feed is given daily unitl the fish have grown to harvest size. Cage farming has several disadvantages. Since the fish are confined and crowded in cages, the potential for parasites and diseases is high. Also, waste products of carbon dioxide, ammonia. urea, and feces build up rapidly. Proper water quality within the cage can be maintained only by frequent dilution of the cage water with water of the surrounding environment. The many advantages to cage farming include (1) easy, complete harvesting; (2) harvests suited to meet market demands; (3) reduced need for harvest equipment; (4) harvesting without draining and loss of water; (5) adaptability to all types of water environments; (6) closer observation of feeding activity; (7) easier, cheaper, and more effective parasite treatment; and (8) a better distribution of food among the fish. Cage materials, cage size, cage covers, feeding rings, cage placements, stocking density, feeding, handling, and parasite and disease control are discussed. (See also W72-10040) (Settle-Wisconsin)

AN OUTDOOR RECREATION PLAN FOR

WYOMING,
Wyoming Recreation Commission, Cheyenne.

wyoning Rectator Commission, Caeyenne.

C. Phillips, and D. M. Blood.

Available from the National Technical Information Service as PB-203 151, \$6.00 in paper copy, \$0.95 in microfiche. October, 1970. 374 p, 19 fig. 65 tab, 4 append.

Descriptors: \*Recreation demand, \*Recreation facilities, \*Projections, \*Wyoming, Planning, Management, Costs, Governments.
Identifiers: \*Outdoor recreation.

An outdoor recreation plan is developed to help decision makers formulate a course of action for outdoor recreation programs in Wyoming. In-creases in demand for outdoor recreation facilities

in Wyoming between 1970 and 1985 will arise from increases in Wyoming's population and from increases in the number of non-resident visitors to the state. In order to forecast demand, relation-ships between facility-usage and selected socioeconomic characteristics (income, education, age, residence, occupation, and vacation time) were developed to determine the effects of these were developed to determine the effects of these variables on participation. Assuming that this relationship would be valid in 1985, it was possible to project participation by using 1985 projections for the six socioeconomic variables, adjusting for population increase. The major needs indicated by the plan include (1) an increase in quantity and quality of municipal recreation facilities; (2) a 35-50% increase in camping and picnicking facilities; and (3) an expansion of winter facilities and water sport facilities. These and other principal needs will require about \$4\$ million if they are to be met. Consideration is given to the problems of financing these needs and effectively implementing the overall plan. (Settle-Wisconsin)

## PERSPECTIVES IN URBAN WATER MANAGE-

MENT, Dallas Water Utilities Dept., Tex.

H. J. Graeser.

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In: Proceedings of the 16th Annual Conference on Water for Texas, 'Urban Water Resources Planning and Movement', San Antonio, Texas, September 9-10 1971, Texas Water Resources Institute, p 9-15.

Descriptors: \*Management, \*Water supply development, \*Recycling, \*Social aspects, \*City planning, Costs, Environment, Financing, Technology, \*Water reuse. Identifiers: \*Urban water management, Environ-

mental crisis.

It should be evident that traditional concepts of water supply development have undergone a complete change. Primarily, water has become water regardless of its condition and criteria for values have changed drastically. In many areas of the country, it is no longer a matter of pick and choose for the best source of water as it is utilization of all sources of water. Recycling has become respectable largely due to the environmental crisis. What we have is a far more complex problem with increasingly complex social overtones that must be considered in all phases of technological development. No longer is it a matter of how much water will be required for domestic and industrial and agricultural purposes, but instead, water supply development as a social factor is receiving increasing attention. Although the use of water in different ways in the urban areas will cost a great deal and raise the price of water to the urban dweller, easier and less expensive solutions to problems exist in the urban environment than in agricultural and other rural applications. The potential of reuse exists that will automatically increase available supplies as much as 30% provided the necessary research is done and public ac-ceptance can be gained before this resource is reallocated to lesser beneficial uses. Also, the financial base exists to pay the price for water and history has shown that as far as basic requirements, water is priceless in the urban environment. (See also W72-10100) (Davis-Chicago) W72-10101

# SYSTEMS DESCRIPTION FOR URBAN WATER

RESOURCES, Alamo Area Council of Governments, San Antonio, Tex. Water Quality Planning.

C. 1. Acci. In: Proceedings of the 16th Annual Conference on Water for Texas, 'Urban Water Resources Planning and Management', San Antonio, Texas, September 9-10 1971, Texas Water Resources In-stitute, p 19-41, 16 fig.

Descriptors: \*City planning, \*Systems analysis, \*Regional analysis, \*Hydrologic systems, Urban

runoff, Evapotranspiration, Planning, Surface waters, Groundwater, Soil water, Analytical techniques, Texas, Information exchange, Data storage and retrieval, Water supply. Identifiers: \*Water inventory systems, San Antonio river, \*Urban water management.

An attempt is made to show how interrelated all An attempt is made to show how interrelated all water fiventory systems are. Attempts to study an inventory system apart from the total system does not enable the investigator to see the total impact of alternatives. A system description is an attempt to define a problem by identifying the interrelationships of numerous events. A complete system description for water resources in an urban environment should enable the investigator to determine the fate of water from the time it appears on mine the fate of water from the time it appears on the region either as evapotranspiration or runoff. The basic concept of the system description for urban water resources management is a complete inventory of the region's water at a given point in time. By comparing such complete inventories at periodic intervals, a general description of the overall flow of water throughout the urban environment can be ascertained. Three basic inventory systems are capable of storing water as an asset to be utilized later as an income supplement to a region. These three systems are: the soil water inventory system, the surface water inventory system, and the ground water inventory system. The operation of all three systems is interrelated and the gains of one system are usually the loss of and the gains of one system are usually the loss of another system. A study area consisting of 16 counties all of which are affected by water management policies in the San Antonio River basin or the Edwards underground water reservoir is used as an example. Even though nomographs have greatly simplified the presentation, planning for water resources is not a simple matter. Probably the greatest amount of work still required is in the field of data capture and required is in the field of data capture and retrieval. The continual flow of information from one field of expertise to another has not been too uccessful. (See also W72-10100) (Davis-Chicago)

# CONJUNCTIVE USE OF SURFACE AND GROUND WATER IN URBAN WATER SUPPLY, Office of Science and Technology, Washington,

W. S. Butcher.

w. S. Butcher.
In: Proceedings of the 16th Annual Conference on
Water for Texas, 'Urban Water resources
Planning and Management', San Antonio, Texas,
September 9-10 1971, Texas Water Resources Institute, p 45-56, 17 ref.

Descriptors: \*Conjunctive use, \*Surface-ground-water relationships, \*Groundwater, \*Water supply, \*City planning, Politicial aspects, Social aspects, Institutional constraints, Economics, Distribution systems, Cost analysis, Optimization, Equity.

Identifiers: \*Least cost, \*Urban water manage-

The urban water planner has many problems, some social, some institutional, some economic, and some technical. Among the technical problems is the question of supplying enough water to meet the demands of the urban area. A groundwater basin has many characteristics that make it a suitable supplement to a process. ble supplement to a surface water system where the groundwater system may function first as a supplement to the overall supply, secondly, as a reservoir, thirdly, as a distribution system and possibly a means by which waste water may be utilized. Optimization techniques can be used to study possible configurations of the ground and surface water systems that may be appropriate in specific situations. To be studied in this manner, some simplification of the system must inevitably be made. Least cost will usually be the objective of such a study ,but maximum equity is concep-tually appealing as an objective. Optimization stu-dies can be used to illuminate issues and study alternatives which in turn can then be examined for their politicial, social and institutional viability.

The addition of desalting to the alternatives in water resources planning is increasing the range of options available to the water resources planner. Conjunctive use of water supply sources for a city with more than one source of available water is possible and economies can often be obtained by the conjunctive operation. Where the multiple sources have different characteristics as is the case with ground and surface water systems, it may be possible to develop an operating strategy which exploits their differences. It is this exploitive strategy that has become known as the con-junctive operation of ground and surface water. (See also W72-10100) (Davis-Chicago)

## FLOOD PLAIN PLANNING IN URBAN AREAS, San Antonio River Authority, Tex. F. N. Pfeiffer.

In: Proceedings of the 16th Annual Conference on Water for Texas, 'Urban Water Resources Planning and Management', San Antonio, Texas, September 9-10, 1971, Texas Water Resources Institute, p 75-83.

Descriptors: \*City planning, \*Flood plains, \*Regulation, \*Community development, Floodproofing, Benefits, Flood plain zoning, Floodways, Building

Identifiers: \*Flood plain management, \*Urban water management.

Flood plain planning and management in urban areas is essential, both in the congested area, where protective measures must be taken, and in the undeveloped areas. An integrated use plan should take into consideration not only the benefits derived from the proper control of flooding but also the adjacent area whether it be the ing but also the adjacent area whence it be the natural setting or high density development. The total environment of any flood plain corridor should be considered in the planning process. As a result all urban dwellers will reap the benefits and live a better life. A discussion about flood plain planning and management necessarily entails a discussion of regulation and zoning. First the flood plain must be defined accurately. Second, once the flood plain is defined, a municipality should adopt the defined flood plain as part of its overall master plan and subdevelopment plats should not be approved unless they conform to the adopted flood plain area. Building permits should not be issued within the flood plain unless certain codes are adopted and enforced with flood proofing or verti-cal adjustment made as standard design criteria. Furthermore, once the waterways are set aside as designated and regulated flood plains, they must be maintained. (See also W72-10100) (Davis-Chicago) W72-10105

## SOCIO-ECONOMIC ASPECTS OF URBAN WATER PLANNING, Alamo Area Council of Governments, San An-

A. Furino.

A. Furino.
In: Proceedings of the 16th Annual Conference on
Water for Texas, 'Urban Water Resources
Planning and Management', San Antonio, Texas,
September 9-10 1971, Texas Water Resources Institute, p 87-103, 4 fig, 1 tab, 20 ref.

Descriptors: \*Comprehensive planning, \*Social aspects, \*City planning, \*Water quality, \*Economic impact, Analytical techniques, Systems analysis, Financial constraints, Timing, Information exchange. Identifiers: \*Urban water planning, \*Policy.

The conceptual framework used at the Alamo Area Council of Governments (San Antonio, Texas) in water quality planning and progress made to date in this program area are described. A comprehensive approach to planning in general is discussed; based on the principle of utilizing aclosed systems earth and the need to treat 'residuals' more accurately. This comprehensive

#### Field 06—WATER RESOURCES PLANNING

## **Group 6B—Evaluation Process**

approach to planning for any one natural resource raises the question of how a decision maker can take into consideration a large and diverse number of variables, as well as the complex ramifications of any one policy. The answer rests with an effective and efficient information system. The AACOG is attempting to break away from the traditional approach to water quality research in order to offer to decision makers of the region more reliable and comprehensive information on which to base policy. The objective is to maintain, within the financial and time onstraints imposed upon the research effort, a broad perspective effectively linking engineering, economic, and social areas to the main goal of any policy: the increase in total human welfare. (See also W72-10100) (Davis-Chicago)

ENVIRONMENTAL ENHANCEMENT - SAN

ANTONIO RIVER WALK,
Texas A and M Univ., College Station.
C. A. Gunn, D. J. Reed, and R. E. Couch.
In: Proceedings of the 16th Annual Conference on
Water for Texas, 'Urban Water Resources Planning and Management', San Antonio, Texas, September 9-10 1971, Texas Water Resources In-stitute, p 107-126, 8 fig, 5 tab, 16 ref.

Descriptors: \*City planning, \*Recreation, \*Stream improve \*Aesthetics, improvement, \*Social Community aspects, Community development, Parks, Scenery, Urban renewal, Psychological aspects,

Identifiers: \*Environmental enhancement, \*San Antonio river walk.

The kiver Walk of San Antonio, Texas, is a highly successful urban river recreational accomplish ment. Once a slough that periodically overflowed into nearby districts, the River Walk is a demonstration of quality urban stream renewal. Although the present River Walk was not designed originally as an entity, it is emerging as a real and identifiable complex. It has overwhelming support of voters owners, managers and visitors. Characteristics of land and building design that are professionally considered of high creative quality are evoking positive response from users and decision makers. Compactness and image identity may be prime vir tues in so small a land and water area having such an impact upon a major city. There seems to be a degree of balance between the park-like setting and business enterprise created by both government and private interests. The policy of a central and attractive circulation system by foot and by special tour boat and the prohibition of per-sonal cars and other watercraft appears to be a sound and workable one. Although port for expansion, the strength of the unity within the present complex suggests extreme care in the design and implementation of any such expansion. Adaptation to other types of physical settings in other areas--wide rivers, lakefronts--may require considerable alteration of plan. Any urban waterfront environment improvements should be concerned with visual and physical access; a melding of public and private interests; landscape and architectural enhancement; development theme or design 'flavor'; emphasis upon history, heritage, and indigenous resources; linkage with physical and social life of city; and visitor safety. (See also W72-10100) (Davis-Chicago)

CONVENTIONAL USE OR REUSE--A COST COMPARISON.

Louis Koenig-Research, San Antonio, Tex.

L. Koenig. In: Proceedings of the 16th Annual Conference on Water for Texas, 'Urban Water Resources Planning and Management', San Antonio, Texas, September 9-10 1971, Texas Water Resources Institute, p 129-152, 4 fig, 6 tab, 12 ref.

Descriptors: \*Cost analysis, \*Costs, \*Economic feasibility, \*Waste water treatment, \*Recycling,

Evaluation, Sewage treatment, Municipal wastes, City planning, Activated carbon, Absorption, Ion exchange, Texas, Electrodia'ysis, Financial feasibility, Demineralization.
Identifiers: \*San Antonio, Texas, \*Advanced

astewater treatment, Clinoptilolite ion exchange, Lime clarification, Recalcination.

This study explores what would happen and what would have to be done if all the sewage flow of a municipality was treated to make it potable and it was recycled to the distribution system. In particular it compares the quantities and costs of this scheme as against the other extremes, namely conventional supply from the next available source nd conventional sewage treatment and discharge. Using San Antonio, Texas as an example, two extreme cases are compared: discharge all water, recycle none and recycle all water, discharge none. In the recycling example, a four-stage advanced waste treatment process was considered: lime clarification, with recalcination, ammonia removal by clinoptilolite ion exchange, activated carbon absorption and finally electrodialysis for demineralization. Reuse in these first approximating computations proves more expensive than conventional supply for San Antonio, but the surprising thing is how close it comes to being competitive, the difference in cost being about 10%. (See also W72-10100) (Davis-Chicago) W72-10108

BUREAU OF RECLAMATION PROGRAMS RE-LATED TO URBAN WATER RESOURCES, Bureau of Reclamation, Amarillo, Tex. Region 5.

In: Proceedings of the 16th Annual Conference on Water for Texas, 'Urban Water Resources Planning and Management', San Antonio, Texas, September 9-10, 1971, Texas Water Resources Institute, p 179-186.

Descriptors: \*City planning, \*Urbanization, \*Water supply, \*Federal government, \*Feasibility studies, Economics, Environment, Federal recla mation act. Financing, Flood control, Recreation, Cost repayment, Cost allocation, Engineering,

Limited provisions have been made in reclamation programs for supplying water for municipal and in-dustrial use (M and I). A number of such projects and their impact on urban water resources are discussed. In general, reclamation projects are normally conceived as a result of a specific public need. When evidence exists that a project has promise after a reconnaissance investigation, authority for a feasibility investigation is requested of Congress. The feasibility investigation tests the engineering, economic, financial and effect on environment aspects of the proposed project. All of these municipal water projects are multipurpose projects. The purposes other than M and I such as flood control, fish and wildlife, and recreation normally share the high cost of present day water resource development. The reimbursa-ble municipal and industrial water supply cost allocation is determined through an equitable alloca-tion procedure. The M and I allocation is reimble with interest over a period of not more than 50 years. The other purposes cited are non-reimbursable except for those projects to which the Federal Water Project Recreation Act applies. The repayment entity must be a legal entity with the authority to levy and collect taxes and/or water charges. (See also W72-10100) (Davis-Chicago) W72-10110

COMPREHENSIVE INTER-BASIN PLANNING AND INTER-GOVERNMENTAL COORDINA-TION.

Texas Water Development Board, Austin. C. R. Baskin.

In: Proceedings of the 16th Annual Conference on Water for Texas, 'Urban Water Resources Planning and Management', San Antonio, Texas, September 9-10, 1971, Texas Water Resources In-stitute, p 189-195.

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Descriptors: \*Comprehensive planning, \*Interbasin transfers, \*Inter-agency cooperation, \*Water resources, \*Analytic techniques, \*Computer programs, Institutional constraints, Planning, Social aspects, Environment, Econom impact, Systems analysis, Computer models, Optimization, Simulation analysis, River basins, Irrigation systems, Estuaries, Groundwater basins, Reservoir operation, Stratification.

\*Inter-governmental coordination, \*Inter-basin planning.

Many years interpose between the initial concep-tion of any substantial water development project and its final construction. More detailed consideration must be given to the economic, social, environmental, and other quality of life factors that are associated with the development of water resources projects. The Texas Water Development Board is concerned with "action", i.e. genuine comprehensive intergovernmental coordination, pointed toward implementing the construction of water resource development projects which have been the subject of substantial past planning stu-dies and endeavors. The Water Development Board has been developing for use in comprehensive inter-basin planning a number of highly so-phisticated tools. An applied research program in the field of water resources systems simulation and optimization has resulted in the development and thorough testing of a number of generalized computer programs that are now available to those needing them to analyze water resources planning problems. Among these programs are the following: River basin analysis, multibasin simulation and analysis, irrigation demand simulation, groundwater basin simulation, stratified reservoir simulation, estuary hydrodynamics simulation and data fill-in and stochastic data generation. (See W72-10100) (Davis-Chicago) W72-10111

THE PROSPECTS FOR PEACE IN THE OCEANS,

For primary bibliographic entry see Field 06E. W72-10173

THE NATIONAL OCEAN PROGRAM, M. Morton. Vital Speeches of the Day, Vol. 38, p 264-267 (1971). 4 p.

Descriptors: \*Research and development, \*Oceans, \*Offshore platforms, \*United States, Monitoring, Administrative decisions, Adoption of practices, Comprehensive planning, Decision making, Leadership, Management, Project planning, Water policy, Governments, Institutional constraints, Control, Coastal structures, Operations research.

Substantial economic and social benefits can be realized by developing our ocean resources, improving ocean transportation and trade, and successfully competing in the world market. The folcessiony compening in the worth market. The toi-lowing oceanic projects are examined: (1) timely development and use of liquified natural gas car-riers; (2) development of large, multi-purpose offshore platforms; and (3) large scale monitoring of the ocean environment, leading to its proper management and control. A number of common threads and synergistic relationships exist among these projects. These include: (1) the enhancement of transportation and trade placing the United States in a better competitive position in the world market place; (2) enhanced employment opportunities and training for our Nation's work force; (3) the opportunity to utilize many of the advanced technologies already developed and re-apply those to solving our pressing ocean problems; (4) the incentive to cooperate with other nations on ocean projects; and (5) the long term alleviation of en-vironmental degradation. The government must provide the necessary management impetus and capital investment in order for industry to have the incentive to implement and carry through this expanded ocean program. (Widman-Florida) W72-10190

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CACHE RIVER BASIN PROJECT, ARKANSAS (DRAFT ENVIRONMENTAL IMPACT STATE-MENT).

Army Engineer District, Memphis, Tenn. For primary bibliographic entry see Field 06E. W72-10192

AN ECOLOGICAL AND RECREATIONAL USE. SURVEY OF THE LUXAPALILA RIVER, Mississippi State Univ., State College. School of

Forest Resources. D. H. Arner, G. A. Anding, W. A. Lunceford, and C. Summerour.

Water Resources Bulletin, Vol 8, No 2, p 367-376, April 1972. 6 fig, 2 tab, 23 ref. OWRR A-029-MISS (2).

Descriptors: \*Ecology, \*Channel improvement, \*Mississippi, \*Surveys, Aquatic life, Aquatic habitats, Recreation, Water pollution, Water quality, Water chemistry, River training, Productivity, Eavironmental effects.
Identifiers: \*Luxapalila River (Miss).

An ecological and recreational use survey was made of the Luxapalila River in Mississippi. This study was made before channelization work was started by the Army Corps of Engineers. Four stations were located along a 10.5 mile stretch of river to make chemical and biological measurements during the four seasons of the year. The river is an appellited his locifically are design and the stretch of the seasons of the year. unpolluted, biologically productive waterway relatively high in chemical constituents. Eleven families and 37 different species of fish were collected. Biomass measurements of standing crops of invertebrates ranged from a low of 0.11 grams oven dry weight per square meter to a high of 18.89 grams per square meter, with larger biomass collected from eddy areas than from riffle areas. Relatively light use is made of the river. Fishing is the major use, followed by swimming. (Knapp-USGS) W72-10267

THE RIVER BASIN MODEL: AN OVERVIEW. Environmetrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06A.

THE RIVER BASIN MODEL: UTILITY DE-PARTMENT. Envirometrics, Inc., Washington, D.C.

For primary bibliographic entry see Field 06A.

THE RIVER BASIN MODEL: HIGHWAY DE-PARTMENT.

Environmetrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06A. W72-10314

THE UNCERTAIN SEARCH FOR ENVIRON-MENTAL POLICY: SCIENTIFIC FACTFIND-ING AND RATIONAL DECISIONMAKING ALONG THE DELAWARE RIVER, Pennsylvania Univ., Philadelphia. School of Law. For primary bibliographic entry see Field 06A. W72-10315

MODELS FOR DETERMINING LEAST-COST INVESTMENTS IN ELECTRICITY SUPPLY, International Bank for Reconstruction and Development, Washington, D.C. For primary bibliographic entry see Field 06A.

AN ALLOCATION MODEL TO DETERMINE AGRICULTURE'S ABILITY TO COMPETE FOR WATER, Florida Univ., Gainesville. Dept. of Agricultural

Economics. For primary bibliographic entry see Field 06A. W72-10317

CLASSIFYING WATER BODIES, Colorado State Univ., Fort Collins. Dept. of Recreation Resources. For primary bibliographic entry see Field 06A.

INLAND WATERWAY TRANSPORT POLICY IN THE U.S., Wyoming Univ., Laramie. D. M. Blood.

Available from the National Technical Informa-tion Service as PB-208 668, \$6.75 in paper copy, \$0.95 in microfiche. National Water Commission Report No. NWC-SBS-72-041, February 1972. 266 p. NWC 71-010.

Descriptors: \*Inland waterways, \*Navigation, \*Transportation, Decision making, Planning, \*Water policy, Identifiers: \*Water resources policy, \*Transportation policy, Economic efficiency, Public expenditure policy, \*Waterway transportation, Common

carriers.

The role of inland waterway transport is analyzed within the dual framework of national water policy and national transportation policy, based on a synthesis of existing information and policy debates about the development and future of inland waterway transport in the United States. A logical framework for identifying and evaluating the problem is developed as a basis for considering the future of inland waterway transport. A descriptive summary of the inland waterway system and industry is given, along with a review of the history and development of the system. There exist many alternative points of view and points of departure for analysis of policy problems which lead, in some instances, to diametrically opposed conclusions; among the reasons for this is whether one views the impact of waterways from a regional or national viewpoint. The need for development of a better technical understanding of the industry as a basis for future policy decisions is stressed, and conflicts in evaluation standards are pointed out. (NWC)

ECONOMIC EVALUATION OF TYPICAL WATER WORKS TELEMETERING SYSTEMS, Metcalf and Eddy, Inc., Boston, Mass. For primary bibliographic entry see Field 05F. W72-10378

A METHODOLOGY FOR INVENTORYING AND EVALUATING THE SCENIC QUALITY AND RELATED RECREATIONAL VALUE OF KANSAS STREAMS: INCLUDES FOUR SELECTED STREAMS, Kansas State Univ., Manhattan. Dept. of Horticul-

ture and Forcessy.

J. I. Nighswonger.

Available from the National Technical Information Service as PB-199 190, \$3.00 in paper copy, \$0.95 in microfiche. Kansas Dept. of Economic Development, Planning Division, Report No. 32, June, 1970.119 p, 12 fig, 19 ref, 1 append.

Descriptors: \*Streams, \*Recreation, \*Intangible benefits, \*Scenery, Value, Evaluation, Kansas. Identifiers: Inventory.

A technique of inventorying, analyzing, and evaluating Kansas streams for their visual quality and related recreational resources was developed. Portions of four streams (Caney River, Lyons Creek, Marais des Cygnes River, and Verdigris River) were selected as study areas to validate and refine the inventory and evaluation techniques. A field rating guide was developed as an inventory method. This guide evaluated the following 20 resources: access, riffles, rapids, waterfalls, dams, bluffs, springs, bridges, natural campsites, improved campsites, specimen plants, caves, pignines, scenic sites, historic sites, rock and fossil areas, wetlands, scenic vistas, bank pollution, and water pollution. An analysis of the general characteristics of each study area was also developed. This established an accurate and specific method of inventorying Kansas streams for their visual quality. A comparison of the total number of resources can also be made. From such information, streams in the state can be compared for their scenic and recreational contributions, and priorities for protection and preservation of worthy streams can be established. The evaluation method ranked the four study areas in the following order: Caney River, Lyons Creek, Verdigris River, and the Marais des Cygnes River. (Settle-Wisconsin) W72-10422

COST-BENEFIT ANALYSIS FOR WATER RESOURCE PLANNING IN ONTARIO, For primary bibliographic entry see Field 06A. W72-10427

## 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

COST TO THE CONSUMER FOR COLLEC-TION AND TREATMENT OF WASTEWATER, Environmental Protection Agency, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. For primary bibliographic entry see Field 05D. W72-09826

THE IMPLICATIONS OF THE NET FISCAL BENEFITS CRITERION FOR COST SHARING IN FLOOD CONTROL PROJECTS. Mathematica, Inc., Bethesda, Md

Available from the National Technical Informa-tion Service as AD 734-834, \$3.00 in paper copy, \$0.95 in microfiche. Army Engineer Institute for Water Resources Report 71-12, September 30, 1971. 121 p, 3 fig, 4 tab, 46 ref. DACW73-71-C-

Descriptors: \*Flood control, \*Cost sharing, \*Mea-surement, Benefits, Costs, State governments, Local governments. Identifiers: \*Net fiscal benefits.

The net fiscal benefits derived by a jurisdiction from a flood control project may be broadly defined as the estimated revenue the jurisdiction would realize, net of the additional public outlays the jurisdiction is likely to undertake, as a result of the direct and indirect consequences of completing a project. In its purest form, the net fiscal benefits criterion would provide that a given jurisdiction's share of the total costs of a flood control project is equal to the dollar value of its estimated set fiscal benefits from the project. This criterion seems particularly useful because it provides a reasonably objective measure of the net benefits a non-federal interest perceives itself as gaining from a flood control project. The fiscal benefits criterion probably should not be considered a tool for achieving economically efficient decisions; its merit lies more in the area of achieving equity between governmental jurisdictions. Several significant problems in the estimation of net fiscal officiant problems in the estimation of net fiscal benefits to state and local governments are identified and further empirical studies recom-mended. (Settle-Wisconsin)

ECONOMICS OF WATER QUALITY AND WASTEWATER CONTROL, California Univ., Los Angeles. Graduate School of

## Field 06-WATER RESOURCES PLANNING

## Group 6C-Cost Allocation, Cost Sharing, Pricing/Repayment

For primary bibliographic entry see Field 05G. W72-10426

COST-BENEFIT ANALYSIS FOR WATER RESOURCE PLANNING IN ONTARIO, For primary bibliographic entry see Field 06A.

## 6D. Water Demand

ECONOMIC IMPACT OF RECREATION-WHO

GETS WHAT, Texas A and M Univ., College Station. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.

COASTAL WATER QUALITY, Texas Water Quality Board, Austin. D. Whittington.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p. 61-70. 2

Descriptors: \*Water quality, \*Water utilization, \*Pollution abatement, Pollutant identification, Water users, Texas. Identifiers: \*Coastal waters.

The Texas Water Quality Board has deemed all Texas coastal waters as suitable for contact recreation, propagation of fish and wildlife, fishing, esthetics, navigation, and industrial cooling water. Certain coastal waters are also suited for the recovery of minerals. These uses require that the coastal waters be maintained in a condition which permits the propagation of fish and wildlife, one of the most demanding of the above uses. The minimum water quality conditions which must prevail for this requirement to be met include (1) an adequate range of salinities to permit marine animals to propagate; (2) temperature levels consistent with the survival and propagation of marine animals; (3) adequate levels of dissolved oxygen; and (4) the absence of high concentrations of toxic materials. To facilitate this objective, the Water Quality Board has adopted numerical requirements for the various coastal water bodies. Enforcement of these requirements, however, depends on the availability of accurate data. Data pertaining to the Texas coast is collected by the Texas Water Quality Board, the State Department of Health, the Parks and Wildlife Department, and the Texas Water Development Board. (See also W72-10040) (Settle-Wisconsin) W72-10050

RAISING CATFISH IN BRACKISH WATERS. Louisiana Wildlife and Fisheries Commission, Grand Chenier. W. G. Perry, Jr.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p. 82-103. 7

Descriptors: \*Catfishes, \*Farm ponds, \*Brackish water, Research and development, Commercial fish, Predation.

The results of catfish culture studies conducted on Rockefeller Wildlife Refuge in the brackish marshes of Southwest Louisiana are discussed. The species included in the study were channel catfish, Ictalurus punctatus; white catfish, Ictalurus catus; and blue catfish, Ictalurus furcatus. The purpose was to determine if these commonly accepted freshwater catfish could be successfully grown in saline waters, and to determine the effects of these marsh waters upon growth, survival, food conversion, and palatability. The channel cat-fish was the best suited for commercial production

in brackish coastal waters. It offers several advantages over the other two catfish, including (1) the most rapid growth, (2) the lowest food conversion value, (3) the highest survival rate, and (4) acceptability as a commercial pond species. One serious problem encountered by the study was serious problem encountered by the study was predation. Otters, mink, frogs, snakes, aquatic insects, and fish-eating birds made major inroads on the fish. Among these animals, the otter represented the greatest threat to the fish, particularly during the colder months when the fish are sluggish. (See also W72-10040) (Settle-Wisconsin) W72-10053

AN OUTDOOR RECREATION PLAN FOR WYOMING,

Wyoming Recreation Commission, Cheyenne. For primary bibliographic entry see Field 06B. W72-10055

THE RIVER BASIN MODEL: AN OVERVIEW. Envirometrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06A. W72-10307

THE RIVER BASIN MODEL: UTILITY DE-

Envirometrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06A. W72-10313

THE RIVER BASIN MODEL: HIGHWAY DE-PARTMENT.

Environmetrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06A.

AN ALLOCATION MODEL TO DETERMINE AGRICULTURE'S ABILITY TO COMPETE FOR WATER, Florida Univ., Gainesville. Dept. of Agricultural

Economics. For primary bibliographic entry see Field 06A.

RECREATIONAL SOCIALIZATION: FACTORS RELATED TO PARTICIPATION IN OUTDOOR

W72-10317

ACTIVITIES, Iowa State Univ., Ames, Dept. of Sociology. J. G. Francis.

M. Sc Thesis, 1971. 75 p, 3 tab, 34 ref, 1 append. Project No. OWRR A-037-IA (4).

Descriptors: \*Recreation demand, \*Recreation, Income, Education, Occupations. Identifiers: \*Socialization, Interviews

The relationship between early socialization and recreation, and present socioeconomic variables affecting socialization and recreation are tested to determine if there is a valid rationale for relating socialization to recreational behavior. The research is based on information gathered by per-sonal interview schedules from 137 individuals in sonal interview schedules from 13/ individuals in six counties in North Central lowa. The interviews were limited primarily to persons living in rural areas and small towns. Early socialization is an important factor in adult recreational activity because patterns of activity established as a child will be retained as an adult. However, the place of residence in early childhood was not statistically significant. Income is probably the most salient factor in recreational participation as an adult. The higher the income, to a point, the higher the par-ticipation rate in outdoor recreation. The variables of occupation and education also were found to influence recreation participation, although their influence is primarily restricted to providing the opportunity to enter a higher-paying occupation. Peer group pressure appeared to have no significant influence on recreation activities. (Settle-Wisconsin)

#### 6E. Water Law and Institutions

FLOOD HAZARD EVALUATION GUIDELINES FOR FEDERAL EXECUTIVE AGENCIES. Water Resources Council, Washington, D.C.

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United States Water Resources Council Publica-tion, May 1972. 20 p, 3 fig, append.

Descriptors: \*Flood plains, \*Land management, \*Standards, \*Inter-agency cooperation, \*Flood protection, Decision making, Property values, Land use, Comprehensive planning, State governments, Federal government, Governmental interrelations, Flood plain zoning.

Identifiers: \*Flood hazard evaluation, Program widelines. Respective Orders 1:300.

guidelines, Executive Order 11296

Guidelines are presented primarily to assist Federal executive agencies toward attaining equa-bility in developing standards for treatment of flood hazard problems when implementing Execu-tive Order 11296. A copy of EO-11296, issued in August 1966, is attached. The Order resulted from August 1966, is attached. The Order resulted from concern over mounting flood losses and recognition that effective programs for prevention or control must be combined with other management elements in a unified national program of floodplain management. An interagency work group first developed proposed guidelines and sent them to the Governors and State agencies for input. The the Governors and State agencies for input. Ine final draft of the guidelines incorporates ideas sub-mitted by Federal and State people and related work done under Water Resources Council auspices. Sketches are included to illustrate the types of land area where flood hazard is commontypes of land area where those hazard is common-riverine, coastal, and debris cones--and each area is described. The Plan Approach and the Case Ap-proach are given as the two basic approaches to evaluation of flood hazard. (Land-USGS) W72-09888

OIL DUMPING BY U.S. NAVY.
Congress, Washington, D.C.; and House,
Washington, D.C.
For primary bibliographic entry see Field 05G.

NATIONAL COASTAL ZONE MANAGEMENT

ACT OF 1972.
Congress, Washington, D.C.; and Committee on Commerce (U.S. Senate).

Senate Comm. on Commerce, S. Rep. No 92-753, 92nd Cong, 2nd Sess. (Comm. Print 1972). 59 p, 1

Descriptors: \*Legislation, \*Estuarine environment, \*Coastal plains, \*Coastal marshes, \*Marsh management, Management, Estuaries, Oceans, Rivers, Wetlands, Coasts, Tidal marshes, Coordination, Land management, Crop production, State government, Local government, Legal aspects, Grants, Administrative agencies.

The coastal zone contains highly productive estua-ries and marshlands. Most estuarine areas equal or double the production rates of the best upland agricultural areas. The bill's main purpose is to encourage and assist the states in preparing and implementing management programs to preserve, protect, develop and restore the resources of the coastal zone of the United States. The bill pro-vides for grants to any coastal state to aid it in developing management programs for the land and water resources of the coastal zone. The bill would create a board and an advisory committee to hear conflicts, advise and make recommendations. It also provides for the development of estuarine sanctuaries. The report includes legislative background material; a section-by-section analysis; and departmental reports from the Comp-troller General, Secretary of the Interior, Environ-mental Protection Agency, National Transporta-tion Safety Board, Federal Maritime Commission, and Department of Commerce. (Nielsen-Florida) W72-09891

CONSTITUTIONALITY OF LOCAL POLLU-TION CONTROL BILL, (FLORIDA ATTORNEY GENERAL'S OPINION), Florida State Dept. of Legal Affairs, Tallahassee.

R. L. Shevin Rep. Att'y. Gen. Fla. 072-43, February 9, 1972. 4 p.

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Descriptors: "Florida, "Constitutional law, "Penalties (Legal), "Legislation, "Water pollution control, "Local governments, State governments, Governments, Legal aspects, Judicial decisions, Water law, Regulation, Water pollution, Governmental interrelations, Law enforcement, State jurisdiction, Jurisdiction, Pollution abatement, Political constraints.

A local pollution control ordinance would not vio-A local pollution control ordinance would not vio-late the Florida constitution as long as the measure did not establish a punishment and left that aspect to state law. The Florida constitution prohibits local laws for the punishment of crimes. Statutes of local application, however, may create a misdemeanor, as long as the punishment is not also prescribed. The state law for punishments of also prescribed. The state law for punsiments of misdemeanors provides only for imprisonment; penalties in the form of fines must be specifically designated by statute. Since the constitution prohibits the designation of punishment in laws of local application and the only state law of general application is limited to imprisonment, no fines could be imposed upon violators. The general pol-lution control law of Florida does not contain criminal penalty provisions. If it did, local pollution control statutes could utilize punishments provided therein. (Brackins-Florida) W72-09892

SUBMERGED LANDS, (FLORIDA ATTORNEY GENERAL'S OPINION), Florida State Dept. of Legal Affairs, Tallahassee.

R. L. Shevin. Rep. Att'y. Gen. Fla. 071-236, August 10, 1971. 4 p.

Descriptors: \*Florida, \*Navigable rivers, \*Watercourses (Legal aspects), \*Riparian rights, \*Owner-ship of beds, Navigable waters, Legal aspects, Ju-dicial decisions, Riparian land, Beds under water, Regulation, Water law, Water rights, Public rights, Grants, Boundaries (Property), Navigation, State governments, Dredging. Identifiers: \*Public trust doctrine, \*Florida Sub-merged Lands Act, \*Wakulla River (Fla.).

The question answered involved application of Florida's Submerged Lands Act to the bed of a river under private ownership claims. Florida's Wakulla River was deemed navigable in the opinion of the Florida Attorney General, although this is not an official determination. In Florida private ownership of riparian lands on navigable waters extends only to the high water mark unless it can be expressly shown the grant extended further. Otherwise the land is held by the state in its sovereign capacity in trust for the lawful uses of all the people. Therefore, a determination that the Wakulla River is a navigable river would subthe Wakula Kivel is a havigable rivel would sup-ject riparian owners thereon to compliance with the Florida Submerged Lands Act; if they desired to dredge, fill, construct docks, or any other artifi-cial encroachment into navigable waters or sovereignty lands, the permission of the Trustees of the Internal Improvement Fund is required. Despite private ownership claims to the water bottoms originating from an 1811 grant, these waters have maintained their character as sovereignty lands during Spanish rule and through cession to the United States and later to Florida. This fact provides the basis for state jurisdiction today. (Brackins-Florida) W72-09893

INTERNATIONAL LAW AND THE OCEANS, THE SEABEDS,
Department of State, Washington, D.C.
J. R. Stevenson.

Vital Speeches of the Day, Vol 36, p 367-369, 1970.

Descriptors: \*International law, \*Oceans, \*Treaties, \*Law of the sea, \*International waters, Foreign waters, Jurisdiction, Legal aspects, Coordination, Continental shelf, Political aspects, Commercial fishing, International commissions, Water law, Continental margin, Governments,

The traditional functions of international law are security, accommodation of interests, and prevention of conflicts. It is suggested that international law should also include the promotion of common objectives and the providing of guideposts on mat-ters heretofore dealt with on a strictly bilateral basis. The law of the sea must then be measured against these criteria. There are two major alternatives regarding legal jurisdiction over the seas: a prohibition of national jurisdiction and a division of the seas among nations in accordance with an agreed formula. There is a need for a new intern tional treaty fixing the limitation of the territorial sea at 12 miles, and providing for freedom of transit and carefully defined preferential fishing rights for coastal states. This treaty could evolve from a new conference on the international law of the sea. Such a conference should: look forward, not back; treat issues in manageable packages; and recognize that the entire seabed issue will be mooted unless there is agreement on the breadth of the territorial sea. (Widman-Florida)

MARINE ENVIRONMENT AND POLLUTION CONTROL, THE FUTURE OF THE SEA, Congress, Washington, D.C.; and Senate, Washington, D.C. G. Nelson.

Vital Speeches of the Day, Vol 36, p 325-329, 1970.

Descriptors: \*Oceans, \*Great Lakes, \*Waste disposal, \*Legislation, \*Pollution abatement, Administration, Administrative decisions, Comrehensive planning, Coordination, Water planning, Coordination, Water management (Applied), Planning, Management, Standards, Administrative agencies, Water quality standards, Governmental interrelations, Water pollution sources, Marine biology, United States.

After listing examples of water pollution Senator Nelson introduces the Marine Environment and Pollution Control Act of 1970. The new Act would make it unlawful for United States citizens, in-cluding corporate and municipal officers, to dispose of refuse material into the Great Lakes, the territorial sea, Outer Continental Shelf waters, or the high seas without a permit from the Secretary of the Interior issued with the concurrence of the Council on Environmental Quality. Such permits would only be granted upon convincing evidence that the disposal will not adversely affect plant and animal life and the marine environment generally. The Act would also establish a system generally. The Act would also establish a system for marine environment management, which would apply to submerged offshore lands under the jurisdiction of the Secretary of the Interior. Finally, the bill would provide for a series of com-prehensive studies designed to supply information on marine ecological systems. This information would be applied to the development of comprehensive resource management plans for the marine environment. (Widman-Florida)

CONGRESS AND FEDERAL POLLUTION CON-Congressional Digest, Vol 49, p 193-224, 1970.

Descriptors: \*Legislation, \*Pollution abatement, \*Federal government, \*Administrative decisions, \*Adoption of practices, Comprehensive planning, Planning, Coordination, Decision making, Con-trol, Governments, Governmental interrelations, United States, Administrative agencies, Leadership, Standards, Federal jurisdiction, Federal Water Pollution Control Act, Water Quality Act, Rivers and Harbors Act, Air pollution. Of the three categories of environmental problems most commonly associated with degradation of the natural environment - air pollution, water pollution, and accumulation of solid wastes - only one, water pollution, has a legislative history which antedates the 20th Century. The successive steps by which a body of federal water law has evolved is described. A listing of federal agencies and pro-grams involved is included. The main features of grams involved is included. The main returner of the Nixon program in this area are outlined, along with environmental action in the Ninety-first Con-gress. Numerous pro and con articles are presented on the questions of: (1) whether Nixon administration moves to date are a sound response to the problems of pollution and (2) whether pri-mary control of anti-pollution efforts should rest with the federal government. (Widman-Florida)

OIL POLLUTION REGULATIONS (DRAFT EN-VIRONMENTAL IMPACT STATEMENT). Coast Guard, Washington, D.C. For primary bibliographic entry see Field 05G. W72-09899

UNITED STATES POLICY ON THE SEABED, R. M. Nixon, E. Richardson, and C. H. Phillips. Department of State Bulletin, Vol 62, p 737-741,

Descriptors: \*International waters, \*Treaties, Descriptors: "International waters, "Treaties, "Natural resources, "Continental margin, "International law, Law of the sea, Continental shelf, Federal government, International joint commissions, Water pollution control, Monetary benefits, Continental slope, Exploration, Sea level, Oceans, Sea

President Nixon has presented United States policy concerning future use of the world's seabed. The President proposed that all nations adopt a treaty renouncing all national claims over the natural resources of the seabed beyond a point where the high seas reach a depth of 200 meters. The treaty would establish an international regime for the exploitation of seabed resources beyond this limit. The regime would provide for collection of substantial mineral royalties to be used for international community purposes, particularly economic assistance to developing countries. Coastal nations would act as trustees for the international community in an international trusteeship zone comprised of the continental margins beyond a depth of 200 meters. Agreed international organizations would authorize and regulate exploration and use of seabed resources beyond the continental margins. Included is Secretary Richardson's statement before the Special Subcommittee on Outer Continen-tal Shelf of the Senate Committee on Interior and Insular Affairs. (Waldron-Florida) W72-09900

WILLIAMS V. SKYLINE DEVELOPMENT CORP. (SEVERABILITY OF RIPARIAN RIGHTS). 288 A.2d 333-356 (Ct. App. Md. 1972).

Descriptors: \*Maryland, \*Riparian rights, \*Land-Descriptors: Maryland, "Raparan rights, "Land-fills, "Judicial decisions, Legal aspects, Navigable waters, Boundaries (Property), Boundary disputes, Land tenure, Ownership of beds, Public rights, Accretion (Legal aspects), Third party ef-fects, Bulkhead line, Docks, Piers, Public access, Cities, State jurisdiction, Permits.

Plaintiff corporate landowner sued defendant cor-porate landowner for injunctive relief and damages on grounds that defendant's construction damages on grounds that defendant's construction of bulkheads and fill operations created an interference with plaintiff's riparian rights. Plaintiff was successor in interest to riparian land originally owned by defendant. The deed from defendant to a third party had specifically reserved riparian rights to the grantor, along with the right to fill over the land beneath the riparian waters. The third party ultimately conveyed the riparian land

#### Field 06-WATER RESOURCES PLANNING

## Group 6E-Water Law and Institutions

to plaintiff. Plaintiff contended that the riparian rights to its tract of land could not legally be severed from the land itself. The Court of Appeals of Maryland held that riparian rights are severable from the land to which they are appurtenant. The court ruled that the deed to the third party was properly construed as reserving riparian rig the defendant grantor. The court also ruled that this deed was in plaintiff's chain of title, which put plaintiff on constructive notice of its provisions and that a recorded plat showing a bulkhead line beyond the boundary to plaintiff's tract should have put plaintiff on inquiry. (Grant-Florida)

TUCCI V. SALZHAUER (PUBLIC RIGHTS TO USE OF FORESHORE).
329 N.Y.S.2d 825-834 (Sup. Ct. 1972).

Descriptors: \*New York, \*Public access, \*Public rights, \*Beaches, Intertidal areas, Shores, Easements, Right-of-way, Legal aspects, Water law, Water utilization, Water rights, Judicial decisions,

Plaintiff owner of dominant tenement sued to enjoin defendant owner of servient tenement from preventing plaintiff from clearing a right-of-way perventing plantin from clearing a right-of-was easement and from interfering with plaintiff's use of land between the high and low water marks in front of defendant's property. Defendant counter-claimed to prevent plaintiff from lounging and holding beach parties on this foreshore area. Plain-tiff asserted that the Doctrine of Jus Publicum gave him the right to use the foreshore area for recreation. Defendant contended that the Doctrine only allowed the plaintiff to use the foreshore area to gain access to the water and not for lounging or beach parties. The New York Supreme Court held that the grant of an easement included the right to keep the right-of-way passable and in a proper state of repair and that the right of the public to use the foreshore area when the tide is out is limited to the right to pass over it as a means of ac-cess to the water. Thus the Court enjoined defendant from preventing plaintiff from clearing his right-of-way and granted defendant judgment on the counterclaim, restricting plaintiff's use of the foreshore to gaining access to the water. (Brackins-Florida)

ENVIRONMENTAL LAW-LANDFILL PERMIT REQUIREMENTS-THE CORPS OF ENGINEERS DOES AN ABOUT FACE (ZABEL V. TABB, 430 F.2D 199 (5TH CIR. 1970)), For primary bibliographic entry see Field 04A. W72-09907

REPRESENTATIVE VANDER JAGT OFFERS ANTIWATER POLLUTION AMENDMENTS TO H.R. 11896,
Congress, Washington, D.C.; and House,

Congress, Wash Washington, D.C. H. S. Reuss.

Congressional Record, Vol 118, No 46, p E3014-3017 (daily ed.) March 24, 1972. 4 p.

Descriptors: \*Treatment facilities, \*Multiple-purpose projects, \*Waste treatment, \*Water pollution ments, Federal government, Local governments, Political aspects, Legal aspects, Project planning, Heat treatment, Sludge treatment, Tertiary treatment, Settling basins, Water purification, Social aspects, Economic efficiency, Costs, Financing, Regulation, Legislation.

Representative Reuss introduced the statement by Representative Vander Jagt concerning amend-ments to the Federal Water Pollution Control Act. Representative Vander Jagt pointed out the apparent ineffectiveness of the current standards approach to pollution control and described the concomitant search by environmentalists for other means to cope with the water quality problem. What is emerging from this effort is a new resource management approach which emphasizes recycling and reclaiming of pollutants. Implicit in this shift from a disposal to a management strategy is a shift from single purpose wastewater planning that seeks to develop sewage treatment facilities to multipurpose planning which formulates plans for total waste management centers. Such centers will provide tertiary treatment of effluents, disposal of removed solids or sludge and municipal and indus-trial solid wastes, dissipation and beneficial use of waste heat, production of agricultural crops, and provision for open space. The Muskegon System is analyzed with respect to treatment costs, effectiveness, and overall feasibility for nation-wide adaptation. Land use implications of the Muskegon type system are also analyzed and found to be preferable to single purpose treatment facilities. (Horwitz-Florida)

TENNESSEE ELECTRIC POWER CO. V. ROBINSON (POWER COMPANY'S LIABILITY FOR OPENING DAM DURING STORM). 8 Tenn. App. 396-405 (1928).

Descriptors: \*Tennessee, \*Dams, \*Cloudbursts, Floods, \*Reservoir releases, Storm water, Thun-derstorms, Rain, Rivers, Hydroelectric plants, Corn (Field), Crops, Water injury, Flood damage, Legal aspects, Judicial decisions, Riparian rights, River regulation, Flood control, Legal review, Overflow, Flow rates, Floodwater, Negligence. Identifiers: \*Proximate causation.

Plaintiff corn farmers sued defendant power com-pany to recover damages for the flooding of their corn crop. Plaintiffs had planted a crop of corn on an island in the river upon which defendant maintained a hydroelectric dam. Following the most severe rain in 44 years, defendant opened the gates of the dam, and the island was overflowed for the first time in 30 years. Defendant contended on appeal that the lower court erred in finding a causal connection between plaintiffs' injury and the opening of the dam, and in finding defendant negligent in opening the dam. The Tennessee Court of Appeals held that it supported the lower court's finding that opening the gates caused out-flow from the dam to exceed inflow, which in turn caused higher water at the island as a direct result of defendant's action. Accordingly, the lower court's decision for plaintiff was affirmed. (Hart-Florida) W72-09909

REPUBLIC CO. OF ROCKFORD V. CITY OF ROCKFORD (CITY'S LIABILITY FAILURE TO REPAIR STORM DRAIN).

251 Ill. App. 109-119 (1928).

Descriptors: \*Acts of God, \*Illinois, \*Storm drains, \*Cities, \*Rain, Surface runoff, Floods, Storm runoff, Legal aspects, Judicial decisions, Sewers, Sewage disposal, Municipal wastes, Water injury, Negligence.

Plaintiff newspaper company sued defendant city for damages resulting from a broken municipal sewer pipe. Defendant's sewer pipe burst during an unprecedented rainfall. Six months before the break, plaintiff showed defendant's agent the break, plaintiff showed defendant's agent the crack in the sewer pipe, and the leakage into plaintiff's basement. Hence, defendant had prior knowledge of the sewer pipe's defective condition. Defendant contended that the breakage occurred from an Act of God, for which defendant was not liable. Plaintiff, however, asserted that since defendant was negligent in maintaining a defective sewer pipe, it was liable despite the unprecedented rain. The Illinois Appellate Court stated that defendant was required to maintain its storm sewers, once installed, and that defendant's liability was conclusive for neglect in repairs. Furthermore, notice to defeadant of the dangerous condition of its sewer was sufficient to render defendant liable for plaintiff's injury, notwithstanding the concurring unprecedented rain. (Hart-Florida)

W72-09910

BASS CANNING CO. V. MACDOUGALD CON-STRUCTION CO. (LIABILITY OF CITY AND CONTRACTOR FOR IMPROPER CONSTRUC-TION OF STORM DRAINS). 162 SE 687-690 (Ga. 1932).

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Descriptors: \*Negligence, \*Georgin, \*Cities, \*Surface runoff, \*Drainage systems, Water injury, Storm drains, Sewers, Drainage water, Construction, Contracts, Legal aspects, Judicial decisions, Storm runoff, Drainage effects, Storm waters, Urban drainage, Urban hydrology.

Plaintiff warehouse owner sued defendants con-Tractor and municipality for damage from flooding. The contractor paved streets and installed storm sewers in accordance with municipal plans; the sewers in accordance with municipal plans; the new sewer opening was raised four feet over the previous one during reconstruction. Although plaintiff protested as to the manner of constructing the sewer during the rebuilding and defendants promised to correct the acknowledged defect, they failed to do so. The first hard rain caused surface water to run into plaintiff's building, which caused plaintiff injury. Defendants contended the improper plans and construction were mere errors in judgment for which they were not liable. The Georgia Supreme Court held for the plaintiff and ruled that a municipality's authority to install a ruled that a municipality's authority to install a drainage system did not permit maintenance of a nuisance by causing surface water to discharge upon plaintiff's property. Furthermore, the court held that defendant contractor was also liable as a circuit tortfacers, since according the fault also joint-tortfeasor, since executing the faulty plan caused plaintiff's injury. (Hart-Florida) W72-09911

C. M. BOTT FURNITURE CO. V. CITY OF BUF-FALO (MUNICIPAL LIABILITY FOR FLOODS CREATED BY ICE-OBSTRUCTED BRIDGES). 131 Misc. Rep. 624, 227 N.Y.S. 660-666 (Sup. Ct.

Descriptors: \*New York, \*Floods, \*Flood damage, "Bridge construction, Bridge design, Bridges, Banks, Surface waters, River flow, Ice jams, Ice, Damages, Maximum probable flood, Overflow, Legal aspects, Judicial decisions, Engineering structures, Bank storage, Flood routing, Streamflow forecasting, Bank protection, River training, Rivers.

Plaintiff manufacturing company brought suit against defendant city for flood damage to its factory. The flood occurred after ice obstructed both a railroad bridge, adjacent to plaintiff's property, and defendant's downstream bridge. Plaintiff conand defendant's downstream bridge. Plaintiff con-tended defendant had been negligent in construct-ing its bridge and in blocking an alleged flood channel by filling private land on the bank op-posite plaintiff's property. Defendant entered a general demand. The New York Supreme Court, Eric County, dismissed plaintiff's complaint and held that, in bridge construction, a city is only lis-ble for flood demans when we better fails to ble for flood damage when such bridge fails to meet ordinary and reasonably forseeable extraorary exigencies. The court also held that the filling of property which confines a creek to its main channel does not constitute a basis for a flood damage complaint. The court ruled the flood so unusual that negligence could not be imputed to the defendant. Defendant was held not liable on the basis of its filling operations since surface waters may be blocked without liability where no continuing flow exists, and defendant's filling had been done on private land. (Earl-Florida)

ACADIA VERMILION RICE IRRIGATING CO. V. MILLER (TITLE TO LAND ALONG SHORE OF LAKE). 178 La. 954, 152 So. 576-578 (1933).

Descriptors: \*Louisiana, \*Boundary disputes, \*Boundaries (Property), Land tenure, Shores,

Lakes, Meanders, Prescriptive rights, Judicial decisions, Legal aspects, Patents, State jurisdiction, Water law, Riparian rights, Riparian land.

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Plaintiff landowner brought suit against defendant landowner to quiet title in land bordering a lake. Plaintiff alleged ownership under a state patent. Defendant denied plaintiff's claim and alleged ownership of state land under a prior patent from Louisiana. Plaintiff contended that defendant's patent conveyed land up to the shoreline of the lake as that shoreline was delineated on State Land Office plats. Defendant contended that the patent conveyed land to the actual shoreline. The trial court found for defendant and the Supreme Court of Louisiana affirmed. The court noted that as a general rule the true boundary is determined by the body of water and not the meander line. The court held, however, that this rule is applicable only when the distance between the actual shoreline and meander line is small. This was not the situation in the instant case, i.e. defendant was held to have acquired title to the contested land because the meander lines did not appear upon the plat at the time defendant's patent was issued and defendant had subsequently acquired title by prescriptive right. (Duss-Florida) W72-09913

PEOPLE V. MILLER (MUNICIPAL TITLE TO CLAMS IN LAND-LOCKED BAY). 235 App. Div. 226, 257 N.Y.S. 300-308 (App. Div.

Descriptors: \*New York, \*State jurisdiction, \*Clams, \*Bays, Commercial shellfish, Conservation, Local governments, State governments, Aquatic animals, Fish, Commercial fishing, Fish migration, Water rights, Fish management, Riparian rights, Ownership of beds, Navigable waters, Cities, Legislation, Judicial decisions, Legal aspects, Land tenure.

Defendant resident fishermen were convicted of violating a state conservation law prohibiting the taking of clams by motor boat. Defendants contended that a local ordinance permitted them to take clams by motor boat in the landlocked bay within the city limits. The state contended that it could legislate as to the property under its police ower for the purpose of conservation of aquatic power for the purpose of conservation of aquatic life. The state also contended that clams are clas-sified as fish and that fish, because of their migratory nature, are classified ferae naturae whose ownership while in a state of freedom is in the state in its sovereign capacity. In reversing the trial court judgment, the Appellate Division of the New York Supreme Court noted that the town under ancient charters had the absolute right to manage the bay, which was entirely within the city limits with no connections to other waters. Clams are not ferae naturae in that they are non-migratory animals closely related to the underwater bed. As to fish which are classified ferae naturae, the state may not legislate over them when found in private property, unless in waters from which they might escape. (Smiljanich-Florida)
W72-09914

UNITED STATES V. ARMCO STEEL CORP. V. RUCKELSHAUS (SUIT PREDICATED ON RIVERS AND HARBORS ACT TO ENJOIN DISCHARGE OF CERTAIN EFFLUENT 333 F. Supp. 1073-1084 (S. D. Texas 1971).

Descriptors: \*United States, \*Rivers and Harbors Act, "Waste disposal, "Industrial wastes, "Injection wells, Effluents, Chemical wastes, Water pollution, Water quality, Water pollution control, Water quality control, Legal aspects, Water pollution sources, Water Quality Act, Legislation, Judi-cial decisions, Navigable rivers, Permits, Federal jurisdiction, Subsurface waters. Identifiers: Injunctions (Prohibitory). Plaintiff United States brought suit to enjoin deremaint United States brought suit to enjoin de-fendant steel company from discharging effluent wastes into the Hudson Ship Channel and from constructing a state-ordered injection well disposal system. Defendant contended that the waste effluents were discharged in solution rather waste effluents were discharged in solution rather than as solids and therefore were not within the purview of the Rivers and Harbors Act. Defendant furthermore alleged that the suit is improvidently brought under the Refuse Act and should have been brought under the Water Quality Act. The United States district court enjoined defendant from discharging the effluents and held that the Water Quality Act does not supersede or emasculate the Refuse Act. The court noted that the volatile and poisonous effluents discharged did constitute violations of the Refuse Act and defendant was prohibited from disposing of the wastes by means of the injection well until there was compliance. pliance with expert's recommendations. (Brackins-Florida) W72-09915

A BILL TO AMEND THE FEDERAL WATER POLLUTION CONTROL ACT.

House Bill 13329, 92nd Cong, 2d Sess. (1972). 190

Descriptors: \*Federal Water Pollution Control Act, \*Legislation, \*Water quality control, \*Pollution abatement, \*Federal government, Navigable tion abatement, "Federal government, Navigable waters, Research and development, Grants, Onsite investigations, Prototypes, Research facilities, Permits, Penalties (Legal), Water quality standards, Waste water treatment, Treatment facilities, Industrial plants, Federal jurisdiction, Administrative agencies, Adoption of practices, State jurisdiction, Effluents, Disposal.
Identifiers: "National Environmental Policy Act, Environmental Protection Agency." **Environmental Protection Agency.** 

Title 1 deals with research and related programs and declares as a matter of policy that all discharges into navigable waters cease by 1985. The Act would be administered by the Environ-mental Protection Agency (EPA). Also covered mental Protection Agency (EPA). Also covered are: comprehensive programs for water pollution; research, investigation, and training programs; state program assistance; mine water pollution control; Great Lakes pollution control; and scholarships. Title 11 deals with grants for con-struction of treatment works and includes administrative conditions and cost guidelines, reimburse-ment for certain state and locally financed treatment works, area-wide waste treatment manage-ment, and basin planning. Standards are established in Title 111 for the following: effluent established in 14th 111 for the following: effluent limitations, aquaculture, scientific information publication, water quality inventory, national performance, toxic and pretreatment effluent standards, inspection monitoring and entry, federal enforcement, international controls, oil and hazardous substance liability, marine sanitation devices, and clean lakes. Permit and license granting is governed by Title IV. This includes certification and the national discharge elimination system. tion and the national discharge elimination system. Title V consists of general administrative provisions, including the water pollution control advisory board, emergency powers and citizen suits, administrative procedure and judicial review, and state authority. (Grant-Florida)

ROLE OF STATE DEPARTMENTS OF AGRICULTURE IN PROBLEMS OF ANIMAL WASTE MANAGEMENT, National Association of State Departments of

Agriculture, Washington, D.C. For primary bibliographic entry see Field 05G. W72-09943

RESPONSIBILITIES OF A PROFESSIONAL SOCIETY TOWARD URGENT SOCIAL PROBLEMS,
Texas A and M Univ. College Station. Dept. of

Agricultural Engineering.

For primary bibliographic entry see Field 05G. W72-09944

PUTTING IT ALL TOGETHER, For primary bibliographic entry see Field 05G. W72-09945

LITIGATION EXPERIENCES OF FIVE LIVESTOCK AND POULTRY PRODUCERS, Iowa State Univ., Ames. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05G.

ENVIRONMENTAL CONSTRAINTS AND THE GENERATION OF NUCLEAR ELECTRIC POWER: THE AFTERMATH OF THE COURT DECISION ON CALVERT CLIFFS, PART 1. Congress, Washington, D.C., and; Committee on Interior and Insular Affairs (U.S. Senate).

Hearing Before the Senate Comm. on Interior and Insular Affairs, 92nd Cong, 1st Sess, November 3, 1971. 293 p, 1 photo, 21 tab.

Descriptors: \*Nuclear power plants, \*Thermal pollution, \*Nuclear wastes, \*Water pollution, Electric power production, Electric power demand, Regulation, Permits, Judicial decisions, Federal Water Pollution Control Act, Federal government, Federal jurisdiction, State jurisdiction, Administrative agencies, Legal aspects, Legislation, Project planning, Water cooling, Engineering structures, Regional development, Investigations, Nuclear reactors.

Identifiers: \*National Environmental Policy Act.

The hearing was held pursuant to Senate Resolution 45, which authorized a study of national fuels and energy policy. Specifically the hearing was to explore the short- and long-term implications of the United States Circuit Court decision in Calvert Cliffs Coordinating Committee v. A.E.C. This decision was a major interpretation of the National Environmental Policy Act. Great concern was voiced over the danger involved in the generation of puchear electric power. The AEC gave its reaction nuclear electric power. The AEC gave its reaction to Calvert Cliffs and discussed attempts to comply with it. Also included was testimony on present construction and planning of nuclear power plants. Others testified on the existence of a power crisis and the need to circumvent the decision in some way. The United States was broken down into sec-tions and analyzed as to the effect that a delay in construction of nuclear power plants would have. Also mentioned was the Baker amendment to the Federal Water Pollution Control Act, which permits agencies to accept certification of water quality from another agency without considering it themselves, a legislative reversal of Calvert Cliffs. (See also W72-10169) (Nielsen-Florida) W72-10168

ENVIRONMENTAL CONSTRAINTS AND THE GENERATION OF NUCLEAR ELECTRIC POWER: THE AFTERMATH OF THE COURT DECISION ON CALVERT CLIFFS, PART 2. Congress, Washington, D.C.; and Committee on Interior and Insular Affairs, (U.S. Senate).

Hearing Before the Senate Comm. on Interior and Insular Affairs, 92nd Cong, 1st Sess, p. 295-844, November 3, 1971. 549 p, 2 map, 5 illus, 12 photo, 40 tab, 9 append.

Descriptors: \*Nuclear power plants, \*Thermal pollution, \*Nuclear wastes, \*Electric power production, Water pollution, Electric power demand, Regulation, Permits, Judicial decisions, Federal government, Federal jurisdiction, State jurisdiction, Administrative agencies, Legal aspects, Legislation, Project planning, Water cooling, Engineering structures, Regional development, Investigations, Nuclear reactors.

Identifiers: \*National Environmental Policy Act.

### Field 06-WATER RESOURCES PLANNING

## Group 6E-Water Law and Institutions

Part 2 of these hearings contains all of the appendices referred to in Part 1, including materials sub-mitted by witnesses at the hearing. An evaluation of nuclear reactor safety was placed in the record. The Atomic Energy Commission listed those nuclear power reactors affected by the Calvert Cliffs decision. The regulations promulgated to conform with the National Environmental Policy Act both before and after the decision were discussed. Another appendix includes answers to questions submitted to the witnesses by members of the committee prior to the hearing. In another area the texts of NEPA and the decision in Calvert Cliffs were republished in whole. Appendix 5 discusses the step-by-step procedure used in licensing of nuclear power reactors. A large collection of correspondence, letters, speeches and articles relevant to the hearings was also included. (See also W72-01068) (Neilsen-Florida)

PERRY COUNTY DRAINAGE AND LEVEE DISTRICTS NOS. 1, 2, AND 3, MISSOURI (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, St. Louis, Mo.

Available from the National Technical Information Service as PB203 775-D, \$3.00 in paper copy, \$0.95 in microfiche. October 26, 1971. 219 p, 3 plate, 4 tab, 5 append.

Descriptors: \*Environmental effects, \*Project planning, \*Flood control, \*Drainage districts, \*Levee districts, Levees, Pumping, Pumping plants, Drainage programs, Drainage engineering, Adoption of practices, Multiple purpose projects, Flood protection, Administrative decisions, Governmental interrelations, Coordination, Comprehensive planning, Missouri, Illinois. Identifiers: \*Environmental Impact Statements, Perry County (Mo), Randolph County (III).

The recommended plan of improvement consists of construction of four pumping stations ranging in size from 60 c.f.s. to 130 c.f.s., and two new drainage ditches totaling 13,900 feet in length. The improvement is located in Perry County, Missouri and Randolph County, Illinois. Improvements will reduce the average area flooded annually from 5850 acres to 2420 acres. It is anticipated that upon the advent of better drainage some of the district's 280 acres of scattered tracts of brush and forest land may eventually be converted to cropland. Aside from the initial decline of some wildlife populations, the improvement will have a minimal adverse effect on ecological systems in the area. The only alternative considered was no development. Included are comments from the Department of Interior; the Department of Agriculture; the Environmental Protection Agency; the Department of Health, Education, and Welfare; the Department of Transportation; the States of Illinois and Missouri; and other interested agencies. Appendixed are reports on hydrology and hydraulics, damages and benefits, and estimates of costs. (Widman-Florida) W72-10170

#### PORT AND HARBOR SAFETY.

Committee on Merchant Marine and Fisheries (U.S. House). Subcommittee on Coast Guard, Coast and Geodetic Survey, and Navigation.

Hearings Before the Subcomm. on Coast Guard, Coast and Geodetic Survey, and Navigation of the House Comm. on Merchant Marine and Fisheries, 92nd Cong, 1st Sess, July 20-22, August 6, 13, 16, 17, 19 and 23, 1971. 402 p, 13 dwg, 2 tab, 2 chart.

Descriptors: "Harbors, "Legislation, "Navigation, "Safety, Inland water ways, Port authorities, Coasts, Transportation, Safety factors, Structural design, Building codes, Coast Guard regulations, Legal aspects, Ships, Water pollution sources, Navigable waters. The hearings covered H.R. 867, H.R. 3635, and H.R. 8140 which promote safety in ports, harbors, waterfront areas, and navigable waters of the United States. Also testimony was taken on H.R. 6232 which would control marine traffic in ports and other waterways. The genesis of this type of legislation was tremendous increase in vessel size, the variety and amount of hazardous cargoes carried in these vessels, and the increase in spills and incidents which have occurred. Through this legislation supporters hope to eventually control the sources of pollution of the nation's coastal waters and the world's oceans. The hearings, held in seven different cities, contained statements from over seventy-five interested parties including members of Congress, port authority representatives, pilots associations, ship owners, and Coast Guard and Navy spokesmen. Included in the discussion is a copy of a United States position paper dealing with tanker size and limitations on discharges. (Nielsen-Florida)

#### TORRENT OF TROUBLE.

Nation's Business, p. 20-23, August 1971. 4 p, 1 il-

Descriptors: \*Rivers and Harbors Act, \*Legislation, \*Permits, \*Pollution abatement, Water pollution control, Water pollution, Law enforcement, Administration, Planning, Administrative agencies, Administrative decisions, Standards, Legal aspects, Judicial decisions, Economic impact, Economics, Water policy.

The Rivers and Harbors Act of 1899 is an ecological weapon which could eventually cost business billions of dollars. The courts have interpreted the Act to mean that nearly every factory, foundry, mill and mine in the United States must obtain a permit to operate from the Corps of Engineers. The exceptions are those whose discharges go directly into public sewage treatment systems. The alternatives include criminal charges and civil suit. It is suggested that the Act places an unreasonable burden on industry in terms of data required. Furthermore as of July 1971 the EPA had not issued industrial guidelines on water purity. It is also suggested that the Act is no real solution to the water pollution problem since the biggest polluters, the farmers, are left virtually untouched. (Widman-Florida) W72-10172

# THE PROSPECTS FOR PEACE IN THE OCEANS.

E. M. Borgese. Saturday Review, p. 15-22, September 26, 1970. 6 p, 11 photo, 1 dwg.

Descriptors: \*Law of the seas, \*International commissions, \*International law, \*International waters, Commercial fishing, Pollution abatement, Coordination, Comprehensive planning, Legal aspects, Political constraints, Treaties, Planning, Administration, Oceans, Miltary aspects.

The international convocation entitled Pacem in Maribus was devoted to clarification of issues raised by impending exploitation of the ocean depths for military and commercial purposes. The following operating principles governing the development of an ocean regime emerged: (1) the ocean environment is an indivisible whole, (2) vast areas of seabed and ocean floor must be beyond the limits of national jurisdiction, (3) the common threat of pollution has rendered traditional claims of sovereignty over offshore waters obsolete, (4) ocean resources are the product of a rapidly changing marine technology, (5) the management of oceans must be based on participation by all nations, (6) such ocean management requires systematic planning that is functionally rather than territorially directed, (7) planning will require coordination of all present activities, and (8) planning must take into account the interfaces between

scientific research and industrial and military development. These principles were then applied to the areas of fishing, new ocean enterprises, and the underwater arms race in an effort to balance a variety of conflicting national claims. Either there will be no ocean regime, with chaotic revolutionary consequences, or there will be a comprehensive structure shaped to political reality. (Widman-Florida) W72-10173

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DUST ABATEMENT AT CANYON FERRY LAKE, CANYON FERRY UNIT, HELENA-GREAT FALLS DIVISION, PICK-SLOAN MISSOURI BASIN PROGRAM MONTANA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Bureau of Reclamation, Washington, D.C.

Available from the National Technical Information Service as PB-203 097-D, \$3.00 in paper copy, \$0.95 in microfiche.

Descriptors: \*Montana, \*Environmental effects, \*Soil conservation, \*Soil erosion, Reservoir design, Impoundments, Reservoir operation, Dikes, Dredging, Flooding, Wildlife habitats, Missouri River, Lake beds, Lake basins, Lakes, Reservoir storage, Forebays, Beach erosion, Turbidity.

Identifiers: \*Environmental Impact Statements.

The proposed project is designed to reduce dust erosion on Canyon Ferry Lake on the Missouri River in Broadwater County, Montana. Dust pol-lution has become a problem on the beaches. The project measures include construction of dikes to form subimpoundments over exposed areas, dredging of fine material from the lakeside to form subimpoundments, and flooding the subimpoundments for development of wildlife habitats. The project would convert a dust wasteland section of the lake to an area of beneficial use without changing the basic lake formation. Other environmental impacts include: enhanced wildlife resources and recreation through development of impound-ments, reduced dust pollution, and development of a new micratory waterfowl production area. Adverse impacts include reduced storage capacity of the reservoir by less than one percent, and tem porary turbidity during construction. Overall lake turbidity should be reduced after completion. Possible alternatives would be to continue the persent partially effective interim measures or to ain the reservoir at higher levels would reduce other project benefits. (Grant-Florida) W72-10174

SUGAR AND BRIAR CREEKS PROJECT, CATAWBA RIVER BASIN, NORTH CAROLINA AND SOUTH CAROLINA (DRAFT ENVIRON-MENTAL IMPACT STATEMENT). Army Engineer District. Charleston, S.C.

Available from the National Technical Information Service as PB-203 232-D, \$3.00 in paper copy, \$0.95 in microfiche. April 30, 1971. 17 p, 7 map, 2 tab.

Descriptors: \*North Carolina, \*Environmental effects, \*Dredging, \*Flood control, \*Channel improvement, Flood protection, Levees, Watershed management, Bank stability, Channels, Stream improvement, Grassed waterways, Public health, Reach (Streams), Aesthetics, Canal embankments, Mosquitoes, Disposal. Identifiers: \*Environmental Impact Statements, Charlotte (N.C).

The purpose of the project is to provide flood control for the city of Charlotte, North Carolina by channelizing 7.6 miles of Little Sugar and Briar Creeks. The size of the canal will vary from a 50-foot bottom width for the lowermost reach to a 30-foot bottom in the upper reaches. The project area is characterized by low, rounded hills and valleys. Channel improvement will eliminate stagnant

pools and mosquito breeding shallows. The major environmental impact will be a reduction in flood-ing. This will have intangible benefits to public health and safety. The channel has been designed health and sately. The channel has been despited to fit within the residential areas through which it passes so as to require a minimal right of way. Dredged material will be used to increase the utili-Dredged material will be used to increase the utility of disposal areas. The major adverse environmental effect will be the temporary aesthetic harm to the stream and adjacent property. Channel banks will be grassed for the entire length and width. Shrubs and trees will be planted on the 20-foot construction easement. Alternatives considered include levied floodways, upstream reservate site and channel improyement. (Grantvoir site, and channel improvement. (Grant-Florida) W72-10175

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COLUMBIA DRAINAGE AND LEVEE DISTRICT NO. 3, MONROE COUNTY, ILLINOIS (DRAFT ENVIRONMENTAL IMPACT STATE-

Army Engineer District, St. Louis, Mo.

Available from the National Technical Informa-tion Service as PB-203 614D, \$3.00 in paper copy, \$0.95 in microfiche. September 10, 1971. 11 p, 1

Descriptors: \*Illinois, \*Environmental effects, \*Environmental control, \*Levee districts, \*Adoption of practices, \*Administrative decisions, Comtion of practices, "Administrative decisions, Comprehensive planning, Project planning, Coordination, Drainage programs, Administration, Multiple-purpose projects, Water management (Applied), Balance of nature, Ecology, Environmental engineering, Decision making, Flood control.

Identifiers: "Environmental Impact Statements, Monroe County (III).

Columbia Drainage and Levee District No. 3 is located in Monroe County, Illinois. The authorized improvement, a modification of the levee project, is designed to provide relief from interior flooding agricultural lands within the district. The plan of improvement consists of construction of pian of improvement consists of construction of two pumping stations with respective capacities of 30 c.f.s. and 200 c.f.s. Approximately 64 acres landward of the levee will be required for project facilities, and ten acres riverward of the levee will be utilized as borrow sites. This draft environmental statement states the primary environmental im-pact to be a reduction of the average area flooded annually from 2,170 acres to 540 acres. It is anannually from 12,70 acres to 340 acres. It is a ticipated that upon the advent of better drainage, approximately 67 acres of brush and forest land will be converted to cropland. Adverse environmental impacts, aside from the initial decline in local wildlife populations, will be minimal. The only feasible alternative is no structural development, flood plain zoning, and flood insurance. Those irretrievable or irreversible commitments of resources involved in this project will be the com-mitment of labor, material, and about 64 acres of agricultural land associated with construction. Approximately 67 acres of brush and forest land will be lost through conversion to cropland. Appendixed is an economic evaluation of the project.
(Widman-Florida) W72-10176

EAST FORK OF WHITEWATER RIVER WATERSHED, INDIANA AND OHIO (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Soil Conservation Service, Washington, D.C.

Available from the National Technical Information Service as PB-203 512-D, \$3.00 in paper copy, \$0.95 in microfiche. October 19, 1971. 16 p, 1 map,

Descriptors: \*Multiple-purpose reservoirs, \*Ohio, \*Indiana, \*Flood protection, \*Environmental effects, Multiple-purpose projects, Flood control, Erosion control, Channel improvement, Watershed management, Diversion structures, Water pollution control, Water supply,

Watersheds (Basins), Impoundments, Municipal water, Industrial water, Wildlife habitats, Recrea-tion, Sedimentation rates, Sediment control, Stream fisheries.

Identifiers: \*Environmental Impact Statement, Whitewater River

The project is designed to improve watershed pro-tection practices for the East Fork of the White-water River watershed in Indiana and Ohio. Project measures include land treatment practices on over 91,000 acres, three multiple-purpose struc-tures for flood protection and public recreation, two multiple-purpose structures for flood preven-tion and municipal and industrial water supply, one flood retarding structure, stream environmental corridor development for public recreation, and channel improvement. The watershed area is approximately 246,900 acres with largely agricultural land usage. Favorable environmental effects include 30% erosion and sediment reduction, flood damage reduction, increased recreational opportu nities, increased water supply sources, creation of lake fisheries and wildlife sanctuaries and habitats, and reduced sediment pollution. Adverse environmental impacts include removal of land from agricultural use, inundation of stream chan-nels, loss of some wildlife habitat through inunda-tion, temporary loss of vegetative cover during channel construction, and temporary loss of fishery values in 2.3 miles of stream. Alternatives considered include the following: retarding structures in middle and lower reaches, land treatment only, groundwater for municipal and industrial use only, and expanding existing recreational develop-ments. (Grant-Florida) W72-10177

THE COMPREHENSIVE BASIN STUDY ON WABASH RIVER, ILLINOIS, INDIANA AND OHIO (DRAFT ENVIRONMENTAL IMPACT STATEMENT).

Army Engineer District, Louisville, Ky.

Available from the National Technical Informa-tion Service as PB-203 615-D, \$3.00 in paper copy, \$0.95 in microfiche. September 1971. 55 p, 1 fig, 6

Descriptors: \*Environmental effects, \*Adoption of practices, \*Environmental control, \*Administrative decisions, \*Comprehensive planning, Project planning, Coordination, Drainage programs, Administration, Multiple-purpose projects, Water management (Applied), Balance of nature, Ecology, Environmental engineering, Decision making, Flood control, Illinois, Indiana, Ohio. Identifiers: \*Environmental Impact Statements,

Wabash River.

This report is a part of the national comprehensive river basin planning program under the aegis of the Water Resources Council. The Ohio River Basin Commission has the statutory responsibility among others, to serve as the principal agency for the coordination of federal, state, interstate, local and non-governmental plans for the development of water and related land resources in the Ohio River Basin. The Wabash River is a major tributa-ry of the Ohio River. The recommended plan for the Wabash Basin consists of flood plain management, land treatment, environmental corridors, and structural features. Recommendations are mad for additional monitoring and data gathering, additional studies, and management innovations where needed. The proposed environmental impact of the plan is to obtain the best use and management of the Basin's water and related land resources through a balanced mix of programs for preservation, enhancement, and development. Adverse environmental effects would be the changes in existing watercourse environment due to required land use. The alternatives to the recommended plan ranged from a non-structural, non-regulatory approach to various scales of development, projected to meet clearly foreseeable needs. (Widman-Florida) W72-10178

BLUE SPRINGS LAKE, LITTLE BLUE RIVER LAKES, MISSOURI (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT). Army Engineer District, Kansas City, Mo.

Available from the National Technical Informa-tion Service as PB-202 652-D, \$3.00 in paper copy, \$0.95 in microfiche. September 13, 1971. 7 p, 3 tab.

Descriptors: \*Missouri, \*Impoundments, \*Environmental effects, \*Project planning, \*Flood control, \*Flood protection, Administrative decisions, Reservoir operation, Reservoirs, Reservoir storage, Comprehensive planning, Water management (Applied), Multiple-purpose projects, Coordination, Surface waters, Water sources. Identifiers: \*Environmental Impact Statements. Little Blue River (Mo).

This project calls for the construction of a dam and reservoir on the East Fork of the Little Blue River in the Kansas City metropolitan area. The River in the Kansas City metropolitan area. The project would be a multiple-purpose reservoir, including flood control and recreation. The impoundment would inundate over 560 acres of agricultural lands, creating a permanent multipurpose pool and providing flood protection downstream from the reservoir. This downstream protection would alleviate potential future damage from rapid urban expansion. The project will provide needed open space in the metropolitan area. The basic loss is the inundation of agricultural lands in the reservoir area; however, the loss of these lands is inevitable due to the rapid urbanization of the area. Thus the development of the proposed project will protect some open space from urbanization and provide for general and water-based recreation. There are no feasible alternatives which would provide the degree of protection desired. Because of the rapid development tection desired. Because of the rapid development of the area, consideration of flood control needs at this time, prior to extensive development, is considered essential. This will avoid some of the dif-ficulties experienced in developed areas where the degree of flood protection and alternate solutions have been limited and expensive. (Widman-Florida) W72-10179

CENTRAL ARIZONA PROJECT, ARIZONA--NEW MEXICO (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Bureau of Reclamation, Washington, D.C.

Available from the National Technical Information Service as PB-202 905-D, \$3.00 in paper copy, \$0.95 in microfiche. September 1971. 61 p, 14 fig, 1

Descriptors: \*Environmental effects, \*Project planning, \*Pumping, \*Water management (Applied), Flow, Hydraulics, Pumping plants, Pumping systems (Mechanical), Water storage, ing systems (Mechanical), water storage, Drainage engineering, Water conveyance, Deci-sion making, Governmental interrelations, Coor-dination, Adoption of practices, Administrative decisions, Arizona, Colorado River. Identifiers: \*Environmental Impact Statements.

The basic plan involves the construction of a series of pumping plants and aquaducts, which will lift Colorado River water from Lake Havasu and lift Colorado River water from Lake Havasu and deliver it for use primarily in Maricopa, Pinal, and Pina Counties, Arizona. Construction of dams and reservoirs on the Salt, Gila, and San Pedro Rivers will provide needed regulatory, conservation, and flood control storage capacity, as well as additional recreational and water exchange opportunities. The Navajo Generating Station will provide electric power for pumping, The allocation of imported Colorado River water to users within the service area will structurally, economically, and imported Colorado River water to users within the service area will structurally, economically, and ecologically influence the human and natural environment. The natural environment will be influenced by continued agricultural production and an expanding population. The existing biota and esthetics will be affected by the construction of reservoirs and the physical modification of topography and vegetation resulting from construction

## Field 06-WATER RESOURCES PLANNING

## Group 6E-Water Law and Institutions

of project facilities. Alternatives considered include no construction and partial construction of the authorized project. (Widman-Florida) W72-10180

CONNECTICUT ACTION NOW, INC. V. ROBERTS PLATING CO. (QUI TAM ACTION BARRED UNDER REFUSE ACT).

457 F.2d 81-90 (2d CIR. 1972).

Descriptors: \*United States, \*Law enforcement, \*Penalties (Legal), \*Rivers and Harbors Act, Water law, Pollution abatement, Water pollution, Water quality control, Water pollution control, Legal aspects, Judicial decisions, Legislation, Federal government, Navigable waters, Waste disposal, Public interest, Regulation, Water resources, Common law.
Identifiers: \*Refuse Act, Standing (Legal).

Plaintiff conservation association sued defendant metal finishing company on behalf of the general public in qui tam for fines and an injunction under the Refuse Act. Defendant was discharging waste materials into navigable waters and the government attorney refused to prosecute. Defendant moved to dismiss, contending that plaintiff lacked standing. Plaintiff contended that the Refuse Act created a limited exception to the rule that crimes would be punished by the Justice Department, not by private citizens. The United States Second Circuit Court of Appeals held that there is no common-law right to maintain a qui tam action; authority must always be found in legislation. Furthermore, in the federal system, crimes are always prosecuted by the federal government, not by private citizens. The court thus held that, under the Refuse Act, a private informer's only right can be to one-half of any fine which has been imposed after criminal proceedings have been brought by the United States. Private persons cannot sue in qui tam for fines under the Act and cannot sue on behalf of the general public to enjoin violations of the Refuse Act. (Brackins-Florida)

PEOPLE EX REL MACMULLEN V. BABCOCK (MICHIGAN PUBLIC TRUST DOCTRINE TRANSCENDS RIGHTS OF RIPARIAN RIPARIAN OWNER).

196 N.W.2d 489-498 (Mich. Ct. App. 1971).

Descriptors: \*Michigan, \*Public rights, \*Ownership of beds, \*Public lands, Lake beds, Beds, Beds under water, Riparian rights, Riparian lands, Water law, Water resources, Navigable waters, Legal aspects, Judicial decisions, Boundary disputes, Boundaries (Property), Great Lakes. Identifiers: \*Public trust doctrine.

Plaintiff state filed suit to enjoin defendant riparian landowners' intended landfill into Lake St. Clair. Defendants contended that they owned the submerged land sought to be filled or, alternatively, that they had riparian rights in the lake which justified ithe intended fill. The Michigan Court of Appeals held that title to submerged lands in the Great Lakes is held by the state subject to a public trust. The trust imposed is for the protection of navigable waters, perservation of fish and game habitats, and assurance of the public's right to fish and boat in the area. Submerged lands held subject to this trust may be disposed of only when the Department of Conservation determines that such lands are of no substantial public value and that the general public interest will not be impaired. Since the proposed landfill was on lands held subject to the public trust, and there was no finding by the Department of Conservation, and the action would interfere with the public interest, the Court enjoined the landfill. (Brackins-Florida) KIND V. JOHNSON CITY (LIABILITY FOR AL-TERING THE NATURAL DRAINAGE FLOW OF SURFACE WATER).

478 S.W.2d 63-66 (Tenn. Ct. App. 1970).

Descriptors: "Tennessee, "Drainage patterns (Geologic), "Drainage systems, "Natural flow, Drainage water, Floods, Surface drainage, Drainage practices, Drainage, Drainage effects, Drainage practices, Surface waters, Flood damage, Water law, Legal aspects, Judicial decisions, Negligence. Identifiers: Nuisance (Legal aspects), Statute of limitations.

Plaintiff landowners sued defendant city for property damages resulting from diversion of surface water onto plaintiff's property through a drainage system constructed by defendant. The drainage system was inadequate to handle the water from ordinary rainfall in the area without producing flooding on plaintiffs' property. Plaintiffs alleged that the system constituted an actionable nuisance by altering the natural drainage flow. Defendant contended that the system did not alter the natural drainage flow in the area. The Tennessee Court of Appeals held that a wrongful interference with the natural drainage of surface water, causing injury to an adjoining landowner, constitutes an actiona-ble nuisance. The city's drainage system was inadequate and frequently water overflowed onto plaintiff's property, thus the system constituted an actionable nuisance, and the city was liable to plaintiffs for damages sustained. (Brackins-Florida) W72-10183

APPLICANT'S ENVIRONMENTAL MENT FOR THE BLUE RIDGE PROJECT. Appalachian Power Co., Roanoke, Va.

Available from the National Technical Informa-tion Service as PB-202 711-D, \$3.00 in paper copy, \$0.95 in microfiche. January 25, 1971. 127 p, 2 map, 8 tab, 3 append.

Descriptors: \*Environmental effects, \*Project planning, \*Hydroelectric plants, \*Pumped storage, hydroelectric power, Alternate planning, Multiple-purpose projects, Electric power, Water management (Applied), Silting, Flood control, Pumping, Reservoir operation, Reservoir storage, Administrative decisions.

Identifiers: \*Environmental Impact Statements,

Gravson County (Va). The Blue Ridge Project will be a combination

hydroelectric and pumped storage project consist-ing of two adjoining and integrated developments. Both developments, located principally in Grayson County, Virginia, will include a reservoir, powerhouse, transmission lines, spillways, concrete lined tunnels and appurtenant facilities. A rockfill dam will be constructed at each development across the New River. The river basin, general, project area, significance of project to project area, downstream area prior to project, significance of project to downstream ecological studies, and environnmental effect of pumping operation are described. Adverse environmental effects include: (1) the flooding of 40,000 acres of land; (2) loss or displacement of about 400 houses, a few small industrial and commercial operations, and farms and woods which now provide a basis for employment; (3) certain short term effects such as earth disturbance and an influx of people connected with the project, placing pressure on existing accommodations; (4) increased land values; (5) increased development of the area with attendant increase in pollution; and (6) drawdowns at the project's upper reservoir. Temporary and local adverse effects on water quality downstream, such as siltation and decreased flow, are expected. No feasible alternaLEGISLATIVE ROUTE 11084, SECTION 3, CAMBRIA COUNTY, PENNSYVANIA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Pennsylvania Dept. of Transportation, Harrisburg.

Available from the National Technical Informa-tion Service as PB-202 083-D, \$3.00 in paper copy, \$0.95 in microfiche. July 1971. 27 p, 5 map, 4

Descriptors: \*Road construction, \*Environmental effects, \*Project planning, \*S' fiment control, \*Administrative decisions, \*Pennsylvania, Comprehensive planning, Road design, Roadbanks, Roads, Adoption of practices, Multiple-purpose projects, Coordination, Administration, Decision making, Water management (Applied). Identifiers: \*Environmental Impact Statements, Siltation control, Glendale Lake (Pa)

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Siltation control, Glendale Lake (Pa).

The purpose of this project is to provide an improved access road to Prince Gallitzin State Park in Cambria County, Pennsylvania. The project will greatly improve safety over that of the existing facility and will increase capacity and operating efficiency. The proposed project will require a total of 14 acres from Prince Gallitzin State Park and 0.67 acres from State Game Lands. During construction a small amount of siltation may wash into Glendale Lake from exposed earthwork areas. The steep hillside and drainage patterns along proposed roadway, and close proximity to Glen-dale Lake will make normal siltation control procedures difficult. The recommended alignment is the only design alignment that has been studied. Any alternative design would deviate from the ex-isting right-of-way, thus requiring more new right-of-way to be taken from the public use lands involved. The farmlands and public use lands that are required for this project must be considered as rreversible commitments of resources. Attached are brief reports from the Pennsylvania Department of Forest and Waters and the Pennsylvania Game Commission. (Widman-Florida) W72-10185

SUN RIVER FLOOD CONTROL PROJECT, SUN RIVER, GREAT FALLS, MONTANA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, Omaha, Nebr.

Available from the National Technical Information Service as PB-199 194-D, \$3.00 in paper copy, \$0.95 in microfiche. March 1971. 33 p, 1 map.

Descriptors: \*Environmental effects, \*Flood protection, \*Channel improvement, \*Levees, Diversion structures, Diversion, Flood control, Floods, Riprap, Vegetation, Lakes, Rivers, Stream improvement, Aquatic habitats, Flood plains, Project benefits, Project purposes, Excavation, Engineering structures.

Identifiers: \*Environmental Impact Statements, Sun River (Mont).

The project consists of levees, interceptor ditches, channel rectification, and appurtenant work on the Sun River, Montana, for flood protection. The meander of the river will not be altered except to the extent of 2,000 feet of channel relocation. Channel improvements and levee construction would result in losses of much riparian habitat along the five miles of river involved. The project along the five miles of river involved. The project would also create two oxbow lakes which would probably be nuisances due to algae odor, safety hazards, and health hazards. River velocity would increase causing some repositioning of the river bottom substrata. The project would provide much needed flood protection, thereby changing land use in the flood plain and raising economic and social values of the land protected. Alternatives in-clude no project, straightening the channel, realig-ning the levee, and dam construction. Irreversible commitment of resources would be loss of existing vegetation, altering aesthetic values of the natural river, and disruption of wildlife habitats. Comments of interested agencies are included. (Brackins-Florida)

tives to the proposed action were found. (Widman-

Florida)

## Water Law and Institutions—Group 6E

TREXLER LAKE PROJECT, JORDAN CREEK, PENNSYLVANIA (DRAFT ENVIRONMENTAL IMPACT STATEMENT).
Army Engineer District, Philadelphia, Pa.

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Available from the National Technical Informa-tion Service as PB-199 232-D, \$3.00 in paper copy, \$0.95 in microfiche. March 1971. 10 p.

Descriptors: \*Environmental effects, \*Dam con-Descriptors: "Environmental effects, "Dam con-struction, "Impoundments, "Pennsylvania, Artifi-cial lakes, Lakes, Project benefits, Project pur-poses, Recreation, Flood control, Water supply, Wildlife habitats, Spillways, Reservoirs, Water resources, Water resources development, Dams, Earth dams, Dam sites, Multiple-purpose projects, Public benefits, Water demand, Water quality, Water pollution, Water quality control, Flood pro-tection.

Identifiers: \*Environmental Impact Statements, Jordan Creek (Pa).

The project consists of an earth and rockfill embankment and a lake in southeastern Pennsylvania for flood control, water supply, and recreation implementation of the project will cause a loss of wildlife habitats, however this loss will be partially mitigated by acquisition of new gameland. It will modify the aesthetic characteristics of the area, remove productive farmland, elimiate some tax raphle lands from the country rolls, and convert ratable lands from the county rolls, and convert 8.6 miles of free flowing stream into a slack water impoundment. The short and long term effects of the project would be to satisfy water supply needs and provide recreation facilities. The project will diminish regional economic losses due to floods. Alternatives are no project, an alternate site, a system of small reservoirs, or regulation of flood plain development by non-structural methods. Irreversible commitment of resources would be 8.6 miles of freeflowing stream and 1,220 acres of land presently devoted to agriculture and wildlife habitat. (Brackins-Florida) W72-10187

HYLTON V. COMBS (BOUNDARY LINE OF PROPERTY RUNNING ALONG MEANDER OF STREAM).

229 Ky. 1, 16 S.W.2d 754-755 (Ct. App. Ky. 1929).

Descriptors: \*Kentucky, \*Boundary disputes, \*Boundaries (Property), \*Meanders, Streams, Land Land tenure, Rivers, Legal aspects, Judicial decisions, Adjacent landowners, State jurisdic-

Plaintiff landowner sought to eject defendant ad-jacent landowner from a tract of land he allegedly owned and to quiet title in the land. The essence of owned and to quiet title in the land. The essence of the dispute was whether the boundary line between two points of the adjacent properties ran in a straight line or followed the meander of a stream. The deeds describing the lands had stated the boundary at this point to be 'down the stream'. The lower court found for plaintiff, finding that the boundary was a straight line between the two points. The Court of Appeals of Kentucky reversed. A boundary line described as up, down, or with a stream will be determined by the meanderings of the stream unless the intent of the parties is clearly otherwise. (Duss-Florida) W72-10188

NEW BEDFORD AND FAIRHAVEN HARBOR, MASSACHUSETTS--SMALL NAVIGATION PROJECT (DRAFT ENVIRONMENTAL IM-

PACT STATEMENT).
Corps of Engineers, Waltham, Mass. New England Div.

Available from the National Technical Information Service as PB-203 156D, \$3.00 in paper copy, \$0.95 in microfiche. September 23, 1971. 108 p, 3 fig, 2 plate, 1 map, 2 photo, 17 tab, 4 append.

Descriptors: \*Environmental effects, \*Dredging, \*Channel improvement, \*Adoption of practices,

\*Administrative decisions, \*Massachusetts, Administration, Channels, Stream improvement, Comprehensive planning, Multiple-purpose projects, Decision making, Planning, Water management (Applied), Navigation, Harbors. Identifiers: \*Environmental Impact Statements, New Bedford (Mass), Fairhaven (Mass).

This project will consist of widening, deepening, and extending navigation channels. The dredged materials will be disposed of at an offshore loca-tion to be determined later with appropriate federal and state agencies. The project is located in the city of New Bedford and the town of Fairhaven, Massachusetts. Environmental impacts in-clude some temporary turbidity which could be as-sociated with dredging and the disposal of the dredged material. No adverse environmental ef-fects are anticipated, nor were any identified dur-ing coordination of the study for this project. Alternatives include an enlarged project with addi-tional dredging for channels and anchorages and no project. The benefit to cost ratio is 1.4. Since the natural environmental resources of the area have already been committed, the proposed project would make no further commitment. Included is the Detailed Project Report. The appendix in-cludes a digest of testimony at public hearing, the New Bedford-Fairhaven Bridge Study, the U. S. Fish and Wildlife Report, the U.S. Coast Guard Report, and comments of local interest. (Widman-

CACHE RIVER BASIN PROJECT, ARKANSAS (DRAFT ENVIRONMENTAL IMPACT STATE-

Army Engineer District, Memphis, Tenn.

Available from the National Technical Informa-tion Service as PB-203 158D, \$3.00 in paper copy, \$0.95 in microfiche. May 3, 1971. 169 p, 11 plate, 20 tab, 4 append.

Descriptors: \*Arkansas, \*Environmental effects, \*Channel improvement, \*Agricultural watersheds, Wildlife habitats, Biological communities, Drainage effects, Flood control, Flood protection, Flood recurrence interval, Wildlife conservation, Hardwood, Agricultural runoff, Water pollution sources, Adoption of practices, Soil erosion, Fishing, Recreation. Identifiers: \*Environmental Impact Statements,

Cache River (Ark).

The project is designed to reduce flooding and improve drainage in the Cache River Basin, Arkan-sas, and to thereby improve agricultural produc-tion. The work will consist of clearing, realignment, and enlargement of approximately 140 miles of channels. The project will reduce flooding by confining most floods within canal banks. Wetlands will be acquired for fish and wildlife mitiga-tion measures. Environmental impact includes reduced flood damage and higher quality of farm-life, improved vector control from drainage, enhanced recreational opportunities, protection of wildlife, increased waterfowl production, and in-creased sport fishing potential. Adverse impacts include future loss of bottomland hardwood, reduced production of remaining bottomland hardwoods, aesthetic loss from channelization creased soil erosion from confinement of flood-waters, increased pollution from agricultural waters, increased pointing in the agreement sources, and damage to wildlife habitats from bisection of game and fish management areas. The following alternatives were considered: project abandonment, reduced mitigation measures, and increased mitigation measures. (Grant-Florida) W72-10192

NAVAJO PROJECT (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT). Bureau of Reclamation, Washington, D.C.

Available from the National Technical Informa-tion Service as PB-203 228D, \$3.00 in paper copy,

\$0.95 in microfiche. September 1971. 246 p, 25 fig. 16 plate, 1 map, 12 photo, 14 tab, 14 ref, 1 append.

Descriptors: "Environmental effects, "Project planning, "Water cooling, "Electric power, "Electric powerplants, "Adoption of practices, Administrative decisions, Decision making, Comprehensive planning, Consumptive use, Multiple-purpose projects, Coordination, Administration, Water management (Applied), Planning, Social aspects, Economics, Water demand, Arizona. Identifiers: "Environmental Impact Statements, Page (Ariz). Page (Ariz).

The Department of Interior, Bureau of Reclama-tion, is a participant in the 2310 megawatt Navajo Generating Station under construction near Page, Arizona. Environmental effects include stack and characteristics and a state and other emissions; disposal of an estimated 1815 tons of ash per day in trenches, where it will be covered with earth; noise from generating station operation, coal mining, and railroad operations; adverse aesthetic impact; possible vapor plumes from the stacks under certain meteorological conditions; dust from coal and ash handling; the possibility of trace element releases from coal burning; consumption of 34,100 acre feet of water annually; consumption of 34,100 acre feet of water annually; possible adverse effects of pumping water for coal mining operation; slight cumulative adverse impact on air and water quality; temporary disruption of normal ingress and egress in the project area and livestock grazing patterns; strip mining; relocation of 23 Navajo families; and temporary and permanent disruption of wildlife habitat. Economic benefits include supply of electrical power, cash royalties, lease payments, and increased funds from property taxes. Alternatives considered include no project, alternative locations of the generating station, several smaller stations, other fuels, geothermal resources, a coal slurry line in lieu of the railroad, alternate railroad routes, trucking coal in lieu of railroads, and alternate transmission lines. (Widman-Florida) W72-10193 W72-10193

COASTAL ZONE MANAGEMENT.
Committee on Public Works (U. S. Senate). Subcommittee on Flood Control - Rivers and Harbors.

Hearing on H.R. 14845, Before the Subcomm. on Rivers and Harbors of the House Comm. on Public Works, 91st Cong. 1st Sess, December 3, 1969. 48

Descriptors: \*Federal Water Pollution Control Act, \*Estuarine environment, \*Legislation, \*Coastal plains, \*Resources development, \*Coastal plains, \*Resources development, Management, Estuaries, Oceans, Rivers, Coasts, Water pollution control, Soil conservation, Land resources, Water resources, Coordination, Land management, Legal aspects, Planning, Federal government.

The environment of the coastal zone is threatened by pollution of its waters and the physical alteration of its lands by housing, industry, and trans-portation development. The hearing included the text of the bill to amend the Federal Water Pollution Control Act to provide for the establishment of a national program for the management, benefi-cial use, protection, and development of land and water resources of the Nation's estuarine and coastal zone. Through this legislation the Secreta-ry of Interior would provide grants to any coastal state to aid in developing a coastal zone manage-ment program. Grants would be made when submitted program plans were approved by the Secre tary. The Secretary would conduct a continuing review of state programs. Advisory committees could be established to consult with and make recommendations to the Secretary, the Deputy Under Secretary and Under Secretary of Interior offered testimony as to the need for such legisla-tion. The findings of a study of the estuarine zones authorized under the Clean Water Restoration Act of 1966 are summarized. (Nielzen-Florida) W72-10194

#### Field 06-WATER RESOURCES PLANNING

## Group 6E-Water Law and Institutions

THE PERMISSIBLE EXTENT OF RIPARIAN LAND, W. H. Farnham.

Land and Water Law Review, Vol. 7, No. 1, p 31-61, 1972. 31 p, 110 ref. OWRR B-003-NY (2).

Descriptors: \*Riparian land, \*Riparian rights, \*Water utilization, Water law, Water rights, Prior appropriation, Water distribution (Applied), Legal appropriation, water distribution (Applied), Legan aspects, Reasonable use, Beneficial use, Watersheds (Basins), Water management (Ap-plied), Water consumption, Consumptive use, Water permits, Water resources, Boundaries (Property), Legislation, Inter-basin transfers, Land use. Riparian waters. Identifiers: \*Constitutional law.

The water law of most eastern states is riparian. Generally, land beyond a watershed is not considered riparian land. Such limitations on riparian land protect lower riparian owners, but restrict the development, management, and beneficial use of water resources. A statutory formulation allowing transfer of riparian rights from riparian to non-riparian land outside a watershed should be allowed, as long as the amount of water used on nonriparian land does not exceed that which could have been lawfully used on the riparian land. Vari-ous rules are utilized to determine the extent of riparian land within a watershed, including: (1) the government survey rule, (2) the smallest tract rule, (3) the no limit rule, and (4) the reasonable limit rule. Legislation defining riparian land as including the watershed limitation and the reasonable limit rule would provide for the optimal distribution of water rights, while protecting the rights of other riparian owners. Such legislation would be a constitutional exercise of the state's police powers. (Brackins-Florida)

HUNTINGTON CANYON GENERATING STA-TION AND TRANSMISSION LINE (DRAFT EN-VIRONMENTAL IMPACT STATEMENT).

Department of the Interior, Washington, D. C.; and Department of Transportation, Washington, D. C.; and Department of Agriculture, Washington, D. C.

Available from the National Technical Informa-tion Service as PB-203 149D, \$3.00 in paper copy, \$0.95 in microfiche. September 17, 1971. 153 p, 6 fig, 4 map, 2 dwg, 25 tab, 2 chart, 1 append.

Descriptors: \*Adoption of practices, \*Environmental effects, \*Electric power, \*Administration, \*Comprehensive planning, Coordination, Balance of nature, Environmental control, Environmental engineering, Administrative decisions, Geother-mal studies, Administrative agencies, Decision making, Industrial production, Multiple-purpose projects, Water management (Applied), Utah. Identifiers: \*Environmental Impact Statements, Huntington Creek (Utah).

The Utah Power and Light Company, Salt Lake City, Utah, is constructing a thermal-electric generating station in Emery County, Utah. A 30,000 acre-foot reservoir on Huntington Creek will be required as a part of the cooling water supply system. Designs and plans for water and air quality control equipment are subject to review by the Secretary of the Interior under a proposed contract whereby the United States will provide a part of the required water supply. Environmental im-pacts will include relocation of Forest Highway Route 7, stack emissions, disposal of an estimated 80,000 tons of ash produced annually, noise from generating station operations, aesthetic impact. dust from coal and ash handling, possible radionuclide release from coal burning, some destruction of stream fishing but enhancement of reservoir fishing, loss of big game wintering lands but overall enhancement of recreational resources, and possible cumulative impacts on air quality of emission from the Huntington Canyon Generating Station on combination with other generating stations in the Southwest. Alternatives considered were alternative locations, several

smaller plants, curtailment of use of electrical energy, substitute fuels, and geothermal resources. The appendix includes numerous details on the project. (Widman-Florida) W72-10196

SURVEY OF INTERSTATE AND INTERNA-TIONAL AQUIFER PROBLEMS, Bittinger (M. W.) and Associates, Inc., Fort Col-lins, Colo.

primary bibliographic entry see Field 02F. W72-10265

INTERBASIN WATER TRANSFERS A POLITI-CAL AND INSTITUTIONAL ANALYSIS,

National Water Commission, Arlington, Va. Social and Behavioral Sciences Div. D. E. Mann.

Available from the National Technical Information Service as PB-208 303, \$6.00 in paper copy, \$0.95 in microfiche. National Water Commission Report No. NWC-SBS-72-037, March 1972. 160 p.

Descriptors: Attitudes, Cost-sharing, Decision Descriptors: Attudes, Coss-saning, Decision making, Demand, Economic justification, Geo-graphical regions, \*Institutional constraints, In-stitutions, \*Interbasin transfers, Interstate, \*Political aspects, Political constraints, Social aspects, Fontical constraints, Social salves, Water allocation, Water conveyance, Water demand, \*Water policy, Water resources development, Water resources, Water supply, Water transfer, Water users.

Identifiers: \*Decisionmaking criteria, \*Institutional mechanisms, Policy guidelines.

Interbasin transfers of water are analyzed in terms of the institutional and political arrangements existing and potentially available in the American political system. The implications of ideology, size, and place of diversion, costs, repayment p icy, timing and staging of transfers, the feasibility of institutional constraints, and the relationship of interbasin transfers to other social goals are explored. Roles of planning institutions and Con-gress are analyzed and strategy recommended. Criteria for evaluation of interbasin transfers are stated and specific recommendations are made in the context of given social goals. Interbasin transfers should be examined as an alternative mode of meeting economic demands for water. Direct and indirect beneficiaries should pay more of the costs and accept greater constraints. Such transfers should be carefully assessed in terms of other social goals. Appropriate institutional steps should be taken to ensure these results. (NWC) W72-10320

INLAND WATERWAY TRANSPORT POLICY IN THE U.S., Wyoming Univ., Laramie.

For primary bibliographic entry see Field 06B. W72-10322

LEGAL DEVICES FOR ACCOMMODATING WATER RESOURCES DEVELOPMENT AND ENVIRONMENTAL VALUES.

Davis, Graham and Stubbs, Denver, Colo W. A. Hillhouse, II., and J. L. DeWeerdt.
Available from the National Technical Informa-\$0.95 in microfiche. National Water Commission Report No. NWC-L-72-043, December, 1971. 763

Descriptors: \*Water resources development, \*Environmental effects, \*Legal aspects, \*Institutions, \*Judicial decisions, \*Planning, \*Permits, \*Power plants, Decision making, Hydroelectric project licensing, Legislation, Water quality.

Identifiers: \*Balancing values, \*Authorization procedures, \*Licensing procedures, \*National En-vironmental Policy Act, \*Delay, \*Power plant sit-ing, \*Public participation, Public trust doctrine, Selected institutional and other legal devices which are used or might be used to strike a balance among environmental and developmental values with respect to water resource projects are discussed. Existing institutional arrangements are described and procedures are recommended to imdescribed and procedures are recommended to im-prove the balancing of values and avoid unneces-sary delay in Federal and non-Federal water pro-jects, and in licensing and permit proceedings. The National Environmental Policy Act is assessed. Case studies examine the Central Arizona Project, the Tocks Island Project, the Cross-Florida Barge Canal, Zabel v. Tabb, the proposed Snake River dams below Hell's Canyon, the Calvert Cliffs atomic power plant, a proposed recreational lake in Wisconsin and the California Peripheral Canal. Litization as a device to resolve conflicts and Litigation as a device to resolve conflicts and other approaches under Federal or State law for balancing environmental and developmental values are discussed. (NWC) W72-10324

W

LEGAL ASPECTS OF CROSS CONNECTION INSPECTIONS,

Washington Univ., Seattle, Bureau of Governmen-

For primary bibliographic entry see Field 05F.
W72-10366

AID FOR WASTEWATER COLLECTION SYSTEMS.

New York State Dept. of Environmental Conservation, Albany. Div. of Pure Waters. For primary bibliographic entry see Field 05D. W72-10391

THE RELATIONSHIP OF ECONOMIC EN-VIRONMENT TO LOCAL GOVERNMENT AC-TIVITIES, CUMBERLAND CO PENNSYLVANIA, Pennsylvania State Univ., University Park.

J. Sobel.

Master's Thesis, September, 1971. 67 p, 18 fig, 5 tab, 3 maps, 21 ref. OWRR B-035-PA (1).

Descriptors: \*Local governments, Property values. Pennsylvania. Identifiers: \*Government services, \*Economic en-

The following basic hypothesis is tested: there is a positive relationship between changes in economic environment and changes in government activity. A growing economic environment creates stress which becomes powerful enough to require accomodation of public policy. This response is increased differentiation of government functions, possibly occurring with a significant time lag. The proxy variable for the economic environment is the market value of real property. The dependent variable, government activity, is measured by the number of public services and administrative number of public services and administrative adaptations a municipality provides. The specific area investigated is in Cumberland County, Pennsylvania, part of the Harrisburg Standard Metropolitan Area. The study suggests that a developing economic environment stimulates an increase in government activity. The increased government activity is more than just an increase or expansion of existing activities. It is the provi-sion of new activities, the acceptance of new levels of governmental responsibility. This relationship was supported by high correlations between the variables for all municipalities in the study area. Those municipalities with the greatest tive increases in market value of property also had the greatest relative increases in governmental differentiation. (Settle-Wisconsin) W72-10424

## **6F. Nonstructural Alternatives**

FLOOD HAZARD EVALUATION GUIDELINES. FOR FEDERAL EXECUTIVE AGENCIES.
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 06E.

Finality of decisions, Environmental quality stan-

W72-09888

FLOOD PLAIN PLANNING IN URBAN AREAS, San Antonio River Authority, Tex. For primary bibliographic entry see Field 06B. W72-10105

THE COMPREHENSIVE BASIN STUDY ON WABASH RIVER, ILLINOIS, INDIANA AND OHIO (DRAFT ENVIRONMENTAL IMPACT STATEMENT).

Army Engineer District, Louisville, Ky.
For primary bibliographic entry see Field 06E.
W72-10178

## 6G. Ecologic Impact of Water Development

TALLAHALA CREEK LAKE, PASCAGOULA RIVER BASIN MISSISSIPPI (DRAFT ENVIRON-MENTAL IMPACT STATEMENT). Army Engineer District, Mobile, Ala. For primary bibliographic entry see Field 08D. W72-09897

CARBON HILL WATERSHED, MONTANA (DRAFT ENVIRONMENTAL IMPACT STATE-MENT).

Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 08A. W72-09898

OIL POLLUTION REGULATIONS (DRAFT EN-VIRONMENTAL IMPACT STATEMENT). Coast Guard, Washington, D.C. For primary bibliographic entry see Field 05G. W72-09899

SOUTH BRANCH, RAHWAY RIVER, NEW JERSEY FLOOD CONTROL PROJECT, RAHWAY, NEW JERSEY (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, New York. For primary bibliographic entry see Field 08A.

MAINTENANCE OF THE NEWARK BAY, HACKENSACK AND PASSAIC RIVERS NAVIGATION PROJECT (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, New York.

For primary bibliographic entry see Field 04A. W72-09902

GREAT LAKES SNOW REDISTRIBUTION RESEARCH PROJECT (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT. National Oceanic and Atmospheric Administra-

tion, Rockville, Md.
For primary bibliographic entry see Field 03B.
W72-09903

PROPOSED WATER TREATMENT FACILITIES FOR FOSS RESERVOIR, OKLAHOMA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Department of Housing and Urban Development, Fort Worth, Tex. Region VI. For primary bibliographic entry see Field 05F.

ENVIRONMENTAL LAW-LANDFILL PERMIT REQUIREMENTS-THE CORPS OF EN-GINEERS DOES AN ABOUT FACE (ZABEL V. TABB, 430 F.2D 199 (5TH CIR. 1970)), For primary bibliographic entry see Field 04A. W72-09907 NAVIGATION PROJECT, MISSISSIPPI RIVER, FORT MADISON, IOWA. COMMERCIAL BOAT HARBOR, FORT MADISON, IOWA (FINAL ENVIRONMENTAL IMPACT STATE-MENT).

Army Engineers District, Rock Island, Ill. For primary bibliographic entry see Field 04A. W72-09916

MODIFIED HACKNEY FLOODWAY AND CLO-SURE OF MISSION FLOODWAY, LOWER RIO GRANDE FLOOD CONTROL PROJECT, TEXAS (FINAL ENVIRONMENTAL IMPACT STATEMENT). International Boundary and Water Commission,

El Paso, Tex. For primary bibliographic entry see Field 04A. W72-09918

COASTAL MOSQUITO CONTROL, Brazoria County Mosquito Control District, Angleton, Tex. For primary bibliographic entry see Field 06B. W72-10045

UNDERSTANDING ENVIRONMENTAL POLLU-TION.
For primary bibliographic entry see Field 05G.
W72-10124

FORECAST OF KODIAK ISLAND PINK SAL-MON RUNS FROM ABUNDANCE OF JU-VENILES IN ESTUARIES, Washington Univ., Seattle. Fisheries Research

Inst.
For primary bibliographic entry see Field 08I.
W72-10154

A STUDY OF THE FOOD OF JUVENILE MIGRATING PINK SHRIMP, PENAEUS DUORARUM BURKENROAD, Miami Univ., Fla.

For primary bibliographic entry see Field 02L. W72-10159

MEASUREMENT OF THE GROWTH RATES OF MYTILUS CALIFORNIANUS AND MYTI-LUS EDULIS IN MONTEREY HARBOR, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 02L. W72-10160

THE PRODUCTION OF ORGANIC DETRITUS IN A SOUTH FLORIDA ESTUARY, Miami Univ., Fla. For primary bibliographic entry see Field 02L. W72-10163

EXTENSION OF OCEANOGRAPHIC STUDIES IN PUGET SOUND AND THE NORTHEAST PACIFIC OCEAN.

Washington Univ., Seattle. Dept. of Oceanography. For primary bibliographic entry see Field 02L. W72-10166

PERRY COUNTY DRAINAGE AND LEVEE DISTRICTS NOS. 1, 2, AND 3, MISSOURI (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, St. Louis, Mo. For primary bibliographic entry see Field 06E. W72-10170

DUST ABATEMENT AT CANYON FERRY LAKE, CANYON FERRY UNIT, HELENA-GREAT FALLS DIVISION, PICK-SLOAN MISSOURI BASIN PROGRAM MONTANA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Bureau of Reclamation, Washington, D.C. For primary bibliographic entry see Field 06E.

W72-10174

SUGAR AND BRIAR CREEKS PROJECT, CATAWBA RIVER BASIN, NORTH CAROLINA AND SOUTH CAROLINA (DRAFT ENVIRON-MENTAL IMPACT STATEMENT).

Army Engineer District, Charleston, S.C. For primary bibliographic entry see Field 06E. W72-10175

COLUMBIA DRAINAGE AND LEVEE DISTRICT NO. 3, MONROE COUNTY, ILLINOIS (DRAFT ENVIRONMENTAL IMPACT STATEMENT).

MENT).
Army Engineer District, St. Louis, Mo.
For primary bibliographic entry see Field 06E.
W72-10176

EAST FORK OF WHITEWATER RIVER WATERSHED, INDIANA AND OHIO (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 06E. W72-10177

THE COMPREHENSIVE BASIN STUDY ON WABASH RIVER, ILLINOIS, INDIANA AND OHIO (DRAFT ENVIRONMENTAL IMPACT STATEMENT).

Army Engineer District, Louisville, Ky. For primary bibliographic entry see Field 06E. W72-10178

BLUE SPRINGS LAKE, LITTLE BLUE RIVER LAKES, MISSOURI (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT). Army Engineer District, Kansas City, Mo. For primary bibliographic entry see Field 06E. W72-10179

CENTRAL ARIZONA PROJECT, ARIZONA--NEW MEXICO (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Bureau of Reclamation, Washington, D.C. For primary bibliographic entry see Field 06E. W72-10180

APPLICANT'S ENVIRONMENTAL STATE-MENT FOR THE BLUE RIDGE PROJECT. Appalachian Power Co., Roanoke, Va. For primary bibliographic entry see Field 06E. W72-10184

SUN RIVER FLOOD CONTROL PROJECT, SUN RIVER, GREAT FALLS, MONTANA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, Omaha, Nebr. For primary bibliographic entry see Field 06E. W72-10186

TREXLER LAKE PROJECT, JORDAN CREEK, PENNSYLVANIA (DRAFT ENVIRONMENTAL IMPACT STATEMENT).
Army Engineer District, Philadelphia, Pa. For primary bibliographic entry see Field 06E. W72-10187

THE OOLENDY RIVER WATERSHED PRO-JECT, SOUTH CAROLINA (ENVIRONMENTAL IMPACT STATEMENT). Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 08A. W72-10189

CACHE RIVER BASIN PROJECT, ARKANSAS (DRAFT ENVIRONMENTAL IMPACT STATE-MENT).

Army Engineer District, Memphis, Tenn. For primary bibliographic entry see Field 06E. W72-10192

#### Field 06-WATER RESOURCES PLANNING

### Group 6G-Ecologic Impact of Water Development

NAVAJO PROJECT (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT).
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 06E. W72-10193

HUNTINGTON CANYON GENERATING STA-TION AND TRANSMISSION LINE (DRAFT EN-VIRONMENTAL IMPACT STATEMENT). Department of the Interior, Washington, D. C.; and Department of Transportation, Washington, D. C.; and Department of Agriculture, Washington, D. C.; and Department of Agriculture, Washington, D. C.
For primary bibliographic entry see Field 06E.
W72-10196

RECYCLING AND ECOSYSTEM RESPONSE, Michigan State Univ., East Lansing. Inst. of Water Research.

H. K. Stevens, T. G. Bahr, and R. A. Cole Available from the National Technical Informa-tion Service as PB-208 669, \$5.45 in paper copy, \$0.95 in microfiche. National Water Commission Report No. NWC-EES-72-042, February, 1972. 135 p. NWC 71-002.

Descriptors: \*Ecosystems, \*Recycling, \*Watershed management, Stability, Agricultural watersheds, Air pollution, Water pollution,

Rutrophication.

Identifiers: \*Aquatic systems, \*Terrestrial ecosystem, \*Agricultural wastes.

Literature on ecosystem response to water manipulation is reviewed, with emphasis on the need for recycling. Policy implications are discussed. Topics include (1) current ecosystem concepts, (2) the role of materials recycling in ecosystem function, (3) North American watersheds, (4) ecosystem stability and human manipulation, and (5) the role of technology. Management recommendations and areas for functional content of the ture research are included. (NWC) W72-10323

#### 07. RESOURCES DATA

#### 7A. Network Design

WATER RESOURCES INVESTIGATIONS IN NORTH CAROLINA, 1969. Geological Survey, Washington, D.C. For primary bibliographic entry see Field 02A.

#### 7B. Data Acquisition

OPTICAL BRIGHTENERS-A NEW WATER

TRACING REAGENT, Lancaster Univ., Bailrigg (England). For primary bibliographic entry see Field 02F. W72-09882

AUTOMATIC SAMPLER FOR DYE TRACER

STUDIES, Geological Survey, Washington, D.C. Water Resources Div. F. A. Kilpatrick.

ater Resources Research, Vol 8, No 2, p 737-742, June 1972. 4 fig, 7 ref.

Descriptors: \*Sampling, \*Dye releases, \*Tracers, Tracking techniques, Dye dispersion, Dye concen-

A simple, largely mechanical device for automatically collecting periodic discrete water samples for use in dye tracer studies has been developed and successfully used by the U. S. Geological Survey. The device consists essentially of two rows of spring-loaded hypodermic syringes that are released from their closed position at selected time intervals to draw in and retain the desired water samples. The sampler is mounted in a boatlike structure partially immersed in the flow to be sam-pled. (Knapp-USGS) W72-10238

A FREEZING CORE METHOD FOR DESCRIB-ING THE VERTICAL DISTRIBUTION OF SEDI-MENTS IN A STREAMBED,

Waterloo Univ. (Ontario). Dept. of Biology. Z. S. J. Stocker, and D. D. Williams. Limnology and Oceanography, Vol 17, No 1, p 136-138, January 1972. 3 fig. 1 tab, 10 ref.

Descriptors: \*Sampling, \*Alluvium, \*Benthos, \*Freezing, \*Bottom sediments, Sands, Gravels, Bed load samplers, Equipment, Cores.

A technique is described for obtaining in situ samples of substrate from stony streambeds, using liquid nitrogen to freeze the substrate around a standpipe driven into the bed. The numbers of animals collected by this method were compared with those obtained using two other techniques and found to be significantly fewer. Many of the animals vacate the area immediately around the standpipe before the temperature becomes intolerably low. The method, although not complete tolerapy low. I ne method, although not complete-ly successful in its primary objective, does lend it-self to an accurate description of the vertical dis-tribution of sediments under stony streams. Distortion of the physical character of the sedi-ments is minimal as the cross-sectional area of the pipe relative to that of the core is small. Also, if a large stone is cracked, all the parts can be retrieved and its original dimensions can be reconstructed. (Knapp-USGS) W72-10240

COMPARISON OF A GRAB SAMPLER AND

COMPARISON OF A GRAD SAMPLE LARGE VOLUME CORER,
Georgia Univ., Sapelo Island. Marine Inst.
K. L. Smith, Jr. and J. D. Howard. Limnology and Oceanography, Vol 17, No 1, p 142-145, January 1972. 1 tab, 18 ref.

Descriptors: \*Sampling, \*Bed load samplers, Alluvium, Bottom sediments, Benthos. Identifiers: \*Grab samplers.

Sampling efficiencies of the Smith-McIntyre grab and the USNEL spade corer were compared based on macrofaunal abundance, biomass, and size. The spade corer's efficiency was greater than that of the grab sampler; this is attributed to its greater depth penetration. (Knapp-USGS) W72-10249

A SIMPLIFIED METHOD FOR THE DETER-MINATION OF SELENIUM IN SOILS AND SEDIMENTS,

Food and Agriculture Organization of the United Nations, Pendik (Turkey). Sheep and Goat Diseases Research Labs. For primary bibliographic entry see Field 05A. W72-10252

THE DETERMINATION OF THE NON--VOLATILE ACIDITY OF RAIN WATER BY A COULOMETRIC PROCEDURE, Rome Univ. (Italy). Istituto di Chimica Aanlitica.

A. Liberti, M. Possanzini, and M. Vicedomini. Analyst, Vol 97, No 1154, p 352-356, May 1972. 3 fig, 1 tab, 3 ref.

Descriptors: \*Chemical analysis, \*Acidity, \*Rain water, \*Colorimetry, \*Analytical techniques, Water chemistry, Hydrogen ion concentration, Water pollution, Water pollution sources, Pollu-tant identification, Potentiometers, Electrodes.

An accurate method for the determination of the non-volatile acidity of rain water or of any dilute acid solution (0.0001 to 0.000001) is described. The method is based on the colorimetric titration of a

sample from which carbon dioxide has been removed by bubbling nitrogen through it. The endpoint is detected by potentiometry with a glass electrode. The acidity from both stron and weak acids is determined. The average standard deviation is plus or minus 5% and the limit of sensitivity 0.1 microgram/milliliter (calculated as sulphuric acid). (Woodard-USGS)

A FULLY AUTOMATED METHOD FOR THE DETERMINATION OF CHEMICAL OXYGEN DEMAND, Imperial Coll. of Science and Technology, London

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(England). Dept. of Chemistry. For primary bibliographic entry see Field 05A. W72-10255

POTENTIAL APPLICATION OF REMOTE SENSING TO ECONOMIC DEVELOPMENT IN DEVELOPING COUNTRIES.

PB-203 310, \$3.00 in paper copy, \$0.95 in microfiche. Proceedings of Symposium held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, 1970, 117 p. AID/csd-2\*08.

Descriptors: \*Remote sensing, \*Water resources development, \*Aerial photography, \*Aircraft, \*Satellites (Artificial), Foreign countries, Economic efficiency, Geology, Engineering structures, Damsites, Irrigation systems, Planning, Mineralogy, Water supply, Costs, Geologic in-vestigations, Geological surveys. Identifiers: \*Earth resources, Developing coun-

Eleven papers are included that were presented at the symposium on potential application of remote sensing to economic development in developing countries, hosted by Smithsonian Institution, November 19-20, 1970, and supported by the Agency for International Development. The purpose of the symposium was to lay the basis for an ction program in the foreign assistance area. Remote sensing activity in developing countries emphasizes aircraft and ground truth data collection which will be integrated with space-derived data. There is a need to develop an indigenous analytical capability so that practical problems of the country involved can be analyzed and, more particularly, that information may be extracted from the spacecraft, aircraft, and ground data to yield decisions and actions. (See also W72-10331 thru W72-10341) (Woodard-USGS) W72-10330

ECONOMIC CONSIDERATIONS IN ASSESSING THE ROLE OF REMOTE SENSING IN COUNTRY DEVELOPMENT, Resources for the Future, Washington, D.C.

In: Proceedings of Symposium on Potential Application of Remote Sensing to Economic Development in Developing Countries, held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 3-13, 1970.

Descriptors: \*Remote sensing, \*Water resources development, \*Data collections, \*Aerial photography, \*Economic feasibility, Foreign countries, Aircraft, Satellites (Artificial), Photogrammetry, Geological surveys, Planning, Evaluation.
Identifiers: \*Earth resources, Developing coun-

Remote sensing of natural resources can be used to generate much information so far as economic development is concerned. Information on the technical possibilities for the use of remote sen-sors, including those carried in satellites, needs to be disseminated, but the more difficult task is that of securing an adequate understanding of the possibilities for use of and a proper expression of demand for information. Experience in Chile and other countries strongly suggests that this cannot be accomplished only by contact between technical experts from the outside and a counterpart set of experts from within the country receiving the aid. There is an indispensable need for face-to-face working contacts between personnel in the information-producing agencies and in the customer agencies who are the actual and potential users of this information. There is considerable variation between the different fields of resource information between the different fields of resource informathis information. There is considerable variation between the different fields of resource information in the degree to which users are aware of technical possibilities for using data generated with the aid of remote sensors. (See also W72-10330) (Woodard-USGS)

USE OF EARTH RESOURCES SURVEYS AND REMOTE SENSING DATA IN DEVELOPING

Geological Survey, Washington, D.C. Office of In-ternational Geology.

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J. A. Keinemund.

In: Proceedings of Symposium on Potential Application of Remote Sensing to Economic Development in Developing Countries, held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 14-21, 1970.

Descriptors: \*Remote sensing, \*Water resources development, \*Aerial photography, \*Data collec-tions, Foreign countries, Aircraft, Satellites (Ar-tificial), Analytical techniques, Geologic investigations, Photogrammetry. Identifiers: \*Earth resources, Developing coun-

From experiences of the U.S. Geological Survey in the use of information on current projects, some problems in the field of application of remote sensors technology in the developing countries are discussed. The area of discussion is confined to information as applied to studies of minerals and water, geologic hazards and land utilization, and engineering problems. One program involves experimentation on carrying mercury detectors in aircraft. The detectors seem to be fairly successful aircraft. The detectors seem to be fairly successful if kept close to the ground and in certain environments. The USGS is experimenting with new uses of the old concepts of radiometric surveys and magnetic surveys for mapping purposes as well as with new types of photography in the remote sensor realm. (See also W72-10330) (Woodard-USGS) W72-10332

USE OF EARTH RESOURCES SURVEYS AND REMOTE SENSING DATA IN DEVELOPING

COUNTRIES,
Agency for International Development, Washington, D.C. Office of Agriculture and Fisheries. M. L. Cox.

In: Proceedings of Symposium on Potential Application of Remote Sensing to Economic Development in Developing Countries, held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 22-28, 1970.

Descriptors: \*Remote sensing, \*Water resources development, \*Aerial photography, \*Geologic investigations, \*Photogrammetry, Foreign countries, Data collections, Aircraft, Instrumentation, Infrared radiation.

Identifiers: \*Earth resources, Developing coun-

The progress of remote sensing for earth-resources data collections in several developing countries is discussed. For example, the Natural Resources Division of the Inter-American Geodetic Survey has been working throughout Latin America on the utilization of integrated natural resource surveys so that people within the country can eventually carry out the programs. In

East Pakistan there is a proposal for using thermal infrared and black and white and false color at 1:30,000 for determining high water levels, areas of rice production, different kinds of rice, and cracks and failures in Polders. Another project in Thailand is related to hardpans for lateritic soils (See also W72-10330) (Woodard-USGS) W72-10333

TYPE, QUALITY AND QUANTITY OF EARTH RESOURCES DATA REQUIRED BY DEVELOP-ING COUNTRIES, Organization of American States, Washington,

D.C.
K. P. Rodgers.
In: Proceedings of Symposium on Potential Application of Remote Sensing to Economic Development in Developing Countries, held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970:
Agency for International Development Report TA/OST/SM-70-1, p 29-35, 1970.

Descriptors: \*Remote sensing, \*Water resources development, \*Aerial photography, \*Data collections, Foreign countries, Geologic investigations, Publications, Planning, Evaluation.
Identifiers: \*Earth resources, Developing coun-

Data collection of the physical environment should be development-oriented, integrated, and should ideally proceed in a series of phases of increasing intensity of survey from reconnaissance of large areas to detailed study of individual projects. Data collection and analysis ideally should be a continuous and orderly sequence which cultivates in energific development. This is the goal minates in specific development. This is the goal but it is rarely achieved without setbacks. The inbut its rarely acheved without setbacks. The in-terface between data producers and the economists and engineers who implement development is critical. The real problem is com-munication between people and between institu-tions working in different aspects of development. With application of the new technologies of remote sensing in the developing countries, atten-tion should be constantly focused on this critical need for an effective dialogue between data produ-cers and data users. It is this communications interface rather than the ability to use technology that will determine success or failure of efforts to assist the countries. (See also W72-10330) (Woodard-USGS) W72-10334

REMOTE SENSING OF THE ENVIRONMENT AND ECOLOGY OF DEVELOPING COUNTRIES,

Smithsonian Institution, Washington, D.C. Ecology Program. D. W. Jenkins.

In: Proceedings of Symposium on Potential Application of Remote Sensing to Economic Develop-ment in Developing Countries, held at Smithsoni-an Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 36-51, 1970.

Descriptors: \*Remote sensing, \*Water resources development, \*Aerial photography, \*Water supply, Foreign countries, Aircraft, Satellites (Artificial), Erosion, Water table, Monitoring, Ecology, Environment control, Data collections, Water ollution sources.

Identifiers: \*Earth resources, Developing coun-

Some environmental and ecological areas critically requiring study for effective management, and the capabilities of remote sensing to help obtain the necessary data are discussed. The most critical factors and conditions which need to be monitored are the effects of manmade changes on the ecolo-gy and environment. Large areas of the developing countries are in arid regions including desert, dry grasslands, and dry savannah or rangelands. If man permits overgrazing by introduced livestock, lowers the water table with bore holes, plows nonarable land, and sets fires, there will be severe damage to the vegetation with resultant wind and water erosion, causing dustbowls. Remote sensing is extremely valuable for monitoring these effects of manmade changes. Nearly all of these changes can be monitored from aircraft and some by spacecraft if the changes are more extensive. (See also W72-10330) (Woodard-USGS)

COSTS AND CAPABILITIES OF COMMER-CIALLY AVAILABLE SERVICES FOR THE REDUCTION, ANALYSIS, AND INTERPRETA-TION OF REMOTE SENSING DATA, Raytheon Co., Alexandria, Va. Autometric Opera-

In: Proceedings of Symposium on Potential Application of Remote Sensing to Economic Development in Developing Countries, held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 52-58, 1970. 2 tab.

Descriptors: \*Remote sensing, \*Data collections, \*Geological surveys, \*Costs, \*Photogrammetry, Data processing, Research and development, Water resources, Geologic investigations, Identifiers: \*Earth resources, Commercial ser-

The service capabilities of 340 commercial earth-resources related firms are summarized. There are few experienced firms capable of remote sensor data reduction, interpretation, and analysis. The number is growing, but significantly, the current supply exceeds the current demand. Improvements to this commercial capability can be expected if (a) additional successful programs are realized; (b) funding for resource surveys increase; and (c) Government continues to sponsor R and D and application studies and establishes and monitors performance standards. The costs for the remote sensing portions of a resource sur-vey are not easily separated--nor should they be. The elements of a remote sensor survey are interdependent, and closely tied to field work and other elements of the development project. (See also W72-10330) (Woodard-USGS) W72-10336

CAPABILITIES AND COSTS OF COMMERCIALLY AVAILABLE REMOTE SENSING SYSTEMS,

Remote Sensing, Inc., Houston, Tex.

S. M. Spangler. In: Proceedings of Symposium on Potential Appliin: Proceedings of Symposium on Potential Appli-cation of Remote Sensing to Economic Develop-ment in Developing Countries, held at Smithsoni-an Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 59-66, 1970. 1 fig, 1 tab.

Descriptors: \*Remote sensing, \*Geological surveys, \*Aerial photography, \*Photogrammetry, \*Costs, Water resources, Instrumentation, Aircraft, Reviews.
Identifiers: \*Earth resources, Equipment, Costs.

A remote sensing project concerning earth resources consists of four steps: Mission Planning, Data Acquisition, Data Reduction, and Data In-terpretation. Each step is essential to, and drastically affects the performance and cost of the next step. The commercially available airborne remote sing systems are listed according to their place sensing systems are instead according to their place in the electromagnetic spectrum. The most impor-tant cost factor in a sensor system is its effect on the platform cost. Its weight directly affects the size of the aircraft needed. Power requirements also affect the amount of power needed on the air-craft and the sensor's altitude and speed limita-tions also affect the choice of platform. If you can take photographs from 40,000 feet versus 5,000 feet, even though the line mile cost using a jet air-craft is as high as \$18 a line mile, the cost per

#### Field 07-RESOURCES DATA

#### Group 7B-Data Acquisition

square mile is one-fifth of the cost per square mile for lowoalitude photography (\$2 per square mile at 40,000 feet versus \$10 per square mile at 5,000 feet). (See also W72-10330) (Woodard-USGS) W72-10337

NEW TECHNOLOGY IN COLLECTING AND ANALYZING EARTH RESOURCE DATA, Michigan Univ., Ann Arbor. Inst. of Science and Technology.

R. R. Legault.

In: Proceedings of Symposium on Potential Application of Remote Sensing to Economic Development in Developing Countries, held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 67-77, 1970. 7 fig.

Descriptors: \*Remote sensing, \*Water resources development, \*Geologic investigations, \*Aerial photography, \*Instrumentation, Technology, Data collections, Photogrammetry, Aircraft infrared rediction. radiation.

Identifiers: \*Earth resources.

Advances in sensor technology allow radiation sensing from the ultraviolet to the microwave regions of the spectrum. Several methods used in collecting earth-resources data by remote sensing are described. A major source for any country, developed or developing, is the water of that area, and one type of water resource is the ground moisture itself. Very clear contrast is expected because the reflectivity of moist soils is much less than that of dry, independent of the types of soil. Thus, in an infrared aerial photograph collected in the 0.85 - 0.89 region, moist areas are darker than those that are drier. For water or moist soil, photographically the 0.7 - 1 micron band is the most appropriate. The rather sophisticated remote sensing described is an extension of the aerial survey techniques which have a long history in the field of development and resource identification. (See also W72-10330) (Woodard-USGS) W72-10338

DATA ANALYSIS, Geological Survey, Washington, D.C.

W. A. Fischer.

In: Proceedings of Symposium on Potential Application of Remote Sensing to Economic Development in Developing Countries, held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 83-86, 1970. 2 fig.

Descriptors: \*Remote sensing, \*Water resources development, "Geologic investigations, "Aerial photography, "Satellites (Artificial), Data collec-tions, Methodology, Mapping, Foreign countries, Photogrammetry, Aircraft, Technology, Analytical techniques.
Identifiers: \*Earth resources, Data analysis,

Developing countries.

A system that would obtain data having the fewest possible variables, and, thus the most easily usable by the broadest spectrum of technicians and scientists must be first orthographic (map-like) upon acquisition so that it would require little processing to meet the mapping needs of the developing nations. To verify the orthographic character of space photographs a 500,000-scale map and a 250,000-scale map that combine the conventional line map with images taken from the Apollo and Gemini spacecrafts have been prepared. The line maps and the images match per-fectly. With changes in the angle of the sun, the terrain looks totally different because of a change in illumination angle. For this reason the spacecraft should be put in sun synchronous orbit to minimize this effect. Furthermore, one sees a much larger area in an instant of time from space. Space photographs will help geologists and geographers classify land forms and recognize anomalies that then become targets for further investiga-tion. Color infrared photographs are analogous to

the system that will be flown in ERTS-A. In such photographs water is black, vegetation is red, and sediment is blue. (See also W72-10330) (Woodard-USGS) W72-10339

DATA STORAGE AND DISSEMINATION, Purdue Univ., Lafayette, Ind. Lab. of Applications for Remote Sensing.

D. Landgrebe.

In: Proceedings of Symposium on Potential Appli-cation of Remote Sensing to Economic Development in Developing Countries, held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 87-96, 1970. 2 ref.

Descriptors: \*Remote sensing, \*Geological surveys, \*Data collections, \*Data processing, \*Data transmission, Methodology, Water resources development, Geologic investigations, Aircraft,

Photogrammetry. Identifiers: \*Earth resources, Developing coun-

Research and development techniques which will lead to the capabilities for future remote sensing systems are discussed. There are two basic kinds of systems, those which are pictorially oriented and those which are numerically oriented. This dichotomy can often be seen in the manner in which sensors are chosen or designed. For example, a photographic camera is a sensor well suited for pictorial systems. The images produced are rich in spatial resolution and detail. Numerical systems provide ready access to a different type of information. For example, the numerical system provides a speeding of the overall generation of a soil map by merely objectively marking a specific boundary between soil types when the soil type may only be gradually changing from one to the other. (See also W72-10330) (Woodard-USGS) W72-10340

INSTITUTIONAL AND TRAINING REQUIRE-MENTS FOR EXPLOITING REMOTE SENSING IN DEVELOPING COUNTRIES, National Aeronautics and Space Administration, Washington, D.C. Earth Observations Programs.

R. A. Summers.

In: Proceedings of Symposium on Potential Application of Remote Sensing to Economic Develop-ment in Developing Countries, held at Smithsonian Institution, Washington, DC, Nov 19-20, 1970: Agency for International Development Report TA/OST/SM-70-1, p 97-106, 1970. 8 fig.

Descriptors: \*Remote sensing, \*Water resources development, \*Geological surveys, \*Analytical techniques, \*Training, Institutions, Data collections, Costs, Technology, Geologic investigations, Aircraft, Photogrammetry.

Identifiers: \*Earth resources, Developing coun-

Remote sensing activity in developing countries should emphasize aircraft and ground truth data collection which will integrate with space-derived data. There are basically four innovative features to the earth resources survey program. First is the availability of the space platform; second, the development of improved sensors which can provide precise quantitative measurements through a broad range of the electromagnetic spectrum; third, the emerging capability for automated information extraction from data, e.g., terrain feature identification and crop stress detection; and fourth, the development and utilization resource and environmental models which relate remote sensing inputs to decision-oriented information. The kinds of training and educational assistance appropriate to the various developing countries and regions should be the essential driver in the development of institutional details in eac country. (See also W72-10330) (Woodard-USGS) W72-10341

CHLORINATED NAPHTHALENES IN PESTI-CIDE ANALYSIS, Geological Survey, Menlo Park, Calif. Water 08.

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Resources Div. D. F. Goerlitz, and L. M. Law.

Bulletin of Environmental Contamination and Toxicology, Vol 7, No 4, p 243-251, 1972. 7 fig, 2 tab, 8 ref.

Descriptors: \*Chemical analysis, \*Pesticides, \*Chlorinated hydrocarbon pesticides, \*Gas chromatography, Analytical techniques, Insecticides, Chemical properties, Physical properties, Water pollution, Pollutant identification.

Identifiers: Chlorinated naphthalenes, Isomer interference, Biphenyls.

was made to find which study chloronaphthalene isomers may interfere with the gas chromatographic analysis of pesticides. Identification of the chloronaphthalenes was made by use of a Finnigan 150 computer-controlled gas chromatograph-mass spectrometer Similar gas chromatographic columns and operating conditions were employed except helium was used as the carrier gas. The spectrum scans were controlled by the computer, and the scan rate was stepped from 2 milliseconds per atomic mass unit at the low end of the spectrum up to 33 mil-liseconds per atomic mass unit at the high end. Each spectrum was completed in 3.5 seconds and recorded on magnetic tape. Figures show typical spectra of actual chromatographically separated chloronaphthalenes as plotted by the computer output device. Correlations of the spectra to the gas-chromatogram were also made by the computer. The retention times, relative to aldrin, of selected pesticides and chlorinated napthalenes are shown. (Woodard-USGS) W72-10349

COMPUTERIZED OPERATION OF DISTRIBU-TION SYSTEMS, San Antonio City Water Board, Tex

For primary bibliographic entry see Field 05F. W72-10361

ECONOMIC EVALUATION OF TYPICAL WATER WORKS TELEMETERING SYSTEMS, Metcalf and Eddy, Inc., Boston, Mass. For primary bibliographic entry see Field 05F. W72-10378

HYDROSIM--COMPUTERIZED GRAPHICAL STREAM HYDROGRAPH SIMULATION, Montana State Univ., Bozeman, Water Resources Research Center. For primary bibliographic entry see Field 02A. W72-10434

#### 7C. Evaluation, Processing and Publication

A MODEL FOR A LINKED SYSTEM OF MUL-TI-PURPOSE RESERVOIRS WITH STOCHASTIC INFLOWS AND DEMANDS, TexasA and M Univ., College Station. Water Resources Inst. For primary bibliographic entry see Field 02H. W77-09889

A COMPUTER MODEL FOR STORAGE AND LAND DISPOSAL OF ANIMAL WASTES, Florida Dept. of Agricultural Engineering. Univ., Gainesville. For primary bibliographic entry see Field 05G.

W72-09947

# 08. ENGINEERING WORKS

#### 8A. Structures

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LOADS ON BURIED PIPES, Missouri Univ., Rolla. Dept. of Civil Engineering. For primary bibliographic entry see Field 05D.

CARBON HILL WATERSHED, MONTANA (DRAFT ENVIRONMENTAL IMPACT STATE-MENT).

Soil Conservation Service, Washington, D.C.

Available from the National Technical Informa-tion Service as PB-203 315D, \$3.00 in paper copy, \$0.95 in microfiche. October 8, 1971. 13 p, 1 map.

Descriptors: \*Environmental effects, \*Watershed management, \*Drainage, \*Flood protection, Flood control, Land management, Surface runoff, Sur-face waters, Watersheds (Basins), Drainage basins, Floods, Runoff, Mosquitoes, Reservoirs, Dams, Recreation, Water sports, Flood plain in-surance, Flood plain zoning, Flood damage, \*Montana.

Identifiers: \*Environmental impact statements, \*Carbon Hill watershed (Mont).

The proposed watershed project, which will include land treatment, reservoir construction, floodway and drainage system construction, and recreation facilities around Miles City in east central Montana, would reduce flood damage and increase drainage efficiency. Land in the watershed includes irrigated cropland, rangeland, and urban areas. The project would reduce pollutants and sediment being transported to urban areas and the Yellowstone River, eliminate mosquito breeding places, and provide increased recreational facilities. The construction of the floodway and drainage system would result in the inundation of a small amount of rangeland wildlife habitat and the relocation of one farmstead. In addition over 250 acres would be required for the dams, reservoirs, and recreational facilities. Although floodproofing, flood plain zoning, and flood plain insurance were considered, these alternatives were found to be either inadequate, impractical, or not feasible under current programs. (Nielsen-Florida) W72-09898

SOUTH BRANCH, RAHWAY RIVER, NEW JERSEY FLOOD CONTROL PROJECT, RAH-WAY, NEW JERSEY (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT). Army Engineer District, New York.

Available from the National Technical Information Service as PB-205 339D, \$3.00 in paper copy, \$0.95 in microfiche. December 10, 1971. 4 p, 1

Descriptors: \*Environmental effects, \*Flood control, \*Channel improvement, \*Levees, Project planning, Urban renewal, Project feasibility, Optimum development plans, Administrative agen-cies, Area redevelopment, Landfills, Bridges, Grading, Drainage, Pumping plants, Highways, Mud flats, Water pollution, Drainage systems, \*New Jersey. Identifiers: \*Environmental impact statements,

\*Rahway River (N.J.).

The proposed action consists of construction of a flood control project in Rahway, New Jersey. The project would provide protection to urban land against fluvial and hurricane tidal flooding. The project is to be an integral component of an urban redevelopment project. The plan calls for realignment and reshaping of the channel; placement of earth fill; construction of levees, floodwalls and new vehicular bridge; road regrading; and appurtenant interior drainage facilities, including a pump station. The project is expected to improve exist-ing traffic conditions and contribute to mosquito control. The principal adverse environmental ef-fect is the elimination of tidal mud flats along both anks of the river as a result of the levees and filling operations. The environmental value of the area has already been greatly reduced as a result of stream pollution. The study was done in coordination with appropriate state and federal agencies. A diagram of the area is included. (Waldron-Florida) W72-09901

MODIFIED HACKNEY FLOODWAY AND CLO-SURE OF MISSION FLOODWAY, LOWER RIO GRANDE FLOOD CONTROL PROJECT, TEXAS (FINAL ENVIRONMENTAL IMPACT STATEMENT). International Boundary and Water Commission,

El Paso, Tex.
For primary bibliographic entry see Field 04A.
W72-09918

#### PREFABRICATED SUBSURFACE DRAINS,

Connecticut Univ., Storrs. K. A. Healy, and R. P. Long Highway Research Record, No 360, p 57-64, 1971.

Descriptors: \*Subsurface drains, \*Prefabrication, Filters, Plastic pipes, Nylon, Construction practices, Frost heaving, Crop production, Slope stability, Drainage practices, Costs, Evaluation, Subsurface drainage, Subsurface flow, Drainage systems, Drainage, Seepage control, Aluminum. Identifiers: Filter criteria, Drain filters, Groundwater flow, Water collection systems.

The design of a prefabricated subsurface drain system based on well screen criteria is presented. The drain is fabricated by using synthetic cloth (made of nylon chiffon or polyester butterfly) and a channelized core (made of expanded aluminum sheet or vinyl tube fencing) that ensure proper fil-tration and permeability. The field and laboratory tests indicate: (1) A fine mesh cloth is suitable as an effective filter for a wide range of soil types. (2) A thin channelized core allows free movement of A thin channelized core allows free movement of water into the outlet pipe. (3) Prefabricated sub-surface drains are easily handled and installed in the field and allow placement in areas not condu-cive to conventional drain construction. (4) Prefabricated subsurface drains are economically competitive with conventional mineral aggregate systems. Examples of prefabricated drain usage include: (1) stabilization of a slope, (2) groundwater control around a leach field, (3) groundwater interception near a homesite, and (4) frost heave control along a road. Mineral aggregate filters are reviewed. (USBR) W72-10115

REDUCING HAZARDS TO PEOPLE AND ANIMALS ON RECLAMATION CANALS, Bureau of Reclamation, Denver, Colo. H. S. Latham, and J. M. Verzuh. Bureau of Reclamation Report REC-ERC-71-36, Sept 1971. 31 p, 8 fig, 9 photo, 8 tab, 12 ref.

Descriptors: "Hazards, "Canals, "Open channels, "Safety, "Animals, "Equipment, Drowning, Waterways, Evaluation, Surveys, Cost comparisons, Fences, Closed conduits, Construction costs, Operation and maintenance, Legal aspects, Public relations.

Identifiers: "Animal behavior, "Human behavior, "Animal behavior, "Human behavior, "Animal behavior, "Canal between the construction of the c

Safety equipment, Cost curves, Canal covers, Open and Closed Conduit System Prog, Lined canals. Unlined canals.

The Bureau of Reclamation is concerned with in-The Bureau of Reclamation is concerned with in-creasing the safety of people and animals exposed to open waterways. Although the Bureau has had an aggressive canal safety program for many years, approximately 30 people drown every year in Bureau-constructed canals. In the past 5 yr, 152 people drowned in Bureau waterways. In addition to the drowning of people, many animals, mostly deer, are lost annually. An indepth study of the nature and extent of the hazards presented by canals and an evaluation of preventive measures are given. A survey of human drownings in Bureau canals and a review of protective devices and safety practices currently used are presented. The relative effectiveness and costs are compared for right-of-way fences, buried conduits, and covered randor-way femeles, ourset conduits, and covered canals. Information related to the problems of public safety and the preservation of animal life, valuable to waterway planners, designers, and operators, is presented. (USBR) W72-10127

MODEL TESTS OF ENLARGED NAVIGATION CHANNEL AT MILLER SANDS BAR, COLUM-BIA RIVER ESTUARY, Army Engineer Waterways Experiment Station,

Vicksburg, Miss.

F. A. Herrmann, Jr.

Available from the National Technical Informa-tion Service as AD-734 095, \$3.00 in paper copy, \$0.95 in microfiche. Miscellaneous Paper No 2-765, December 1965. 27 p. 13 fig.

Descriptors: \*Columbia River, \*Estuaries, \*Channel improvements, \*Model studies, \*Shoals, Piles, Dikes, Landfills. Identifiers: \*Miller Sands Bar.

Tests were conducted to determine the effects of enlarging the navigation channel at Miller Sands Bar and to ascertain the effectiveness of various combinations of proposed improvements in the Columbia River Estuary model at the U.S. Army Engineer Waterways Experimental Station. To enlarge the channel from 35' x 500' to 40' x 600' with no improvement works is expected to cause approximately a 40% increase in channel shoaling. The most effective plan consisted of placing six pile dikes 1800 ft apart, normal to the predominant flow direction, with an 8700 ft dredge fill. This plan showed a 56% reduction of shoaling in the 40' x 600' channel. (Ensign-PAI) W72-10144

ENVIRONMENTAL CONSTRAINTS AND THE GENERATION OF NUCLEAR ELECTRIC POWER: THE AFTERMATH OF THE COURT DECISION ON CALVERT CLIFFS, PART 1. Congress, Washington, D.C., and; Committee on Interior and Insular Affairs (U.S. Senate). For primary bibliographic entry see Field 06E. W72-10168

ENVIRONMENTAL CONSTRAINTS AND THE GENERATION OF NUCLEAR ELECTRIC
POWER: THE AFTERMATH OF THE COURT
DECISION ON CALVERT CLIFFS, PART 2.
Congress, Washington, D.C.; and Committee on
Interior and Insular Affairs, (U.S. Senate).
For primary bibliographic entry see Field 06E.
W72-10169

PERRY COUNTY DRAINAGE AND LEVEE DIS-TRICTS NOS. 1, 2, AND 3, MISSOURI (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, St. Louis, Mo. For primary bibliographic entry see Field 06E. W72-10170

DUST ABATEMENT AT CANYON FERRY LAKE, CANYON FERRY UNIT, HELENA-GREAT FALLS DIVISION, PICK-SLOAN MISSOURI BASIN PROGRAM MONTANA (DRAFT ENVIRONMENTAL IMPACT STATEMENT).
BUTCH OF REGIONATION WASHINGTON D.C. Bureau of Reclamation, Washington, D.C. For primary bibliographic entry see Field 06E.

#### Field 08—ENGINEERING WORKS

#### Group 8A-Structures

SUGAR AND BRIAR CREEKS PROJECT, CATAWBA RIVER BASIN, NORTH CAROLINA AND SOUTH CAROLINA (DRAFT ENVIRON-MENTAL IMPACT STATEMENT). Army Engineer District, Charleston, S.C.

rimary bibliographic entry see Field 06E. For primar W72-10175

EAST FORK OF WHITEWATER RIVER WATERSHED, INDIANA AND OHIO (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 06E.

BLUE SPRINGS LAKE, LITTLE BLUE RIVER LAKES, MISSOURI (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, Kansas City, Mo.

For primary bibliographic entry see Field 06E. W72-10179

APPLICANT'S ENVIRONMENTAL STATE-MENT FOR THE BLUE RIDGE PROJECT. Appalachian Power Co., Roanoke, Va. For primary bibliographic entry see Field 06E.

SUN RIVER FLOOD CONTROL PROJECT, SUN RIVER, GREAT FALLS, MONTANA (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, Omaha, Nebr. For primary bibliographic entry see Field 06E. W72-10186

THE OOLENDY RIVER WATERSHED PROJECT, SOUTH CAROLINA (ENVIRONMENTAL IMPACT STATEMENT). Soil Conservation Service, Washington, D.C.

Available from the National Technical Informa-tion Service as PB-201 687D, \$3.00 in paper copy, \$0.95 in microfiche. July 1971. 12 p.

Descriptors: \*Environmental effects, \*Flood protection, \*Erosion control, \*Multiple-purpose pro-jects, Reservoirs, Watersheds (Basins), Watershed management, Channel improvement, Flood damage, Floods, Flood plains, Land management, Agriculture, Erosion, Sediments, Recreation, Water management (Applied), Project purposes, Project benefits, Water resources, Wil-dlife habitats, Spillways. Identifiers: \*Environmental Impact Statements,

Ooledy River (SC).

The project will consist of six floodwater-retarding structures, a reservoir, channel improvement and conservation land treatment. The project will be on the Oolendy River Watershed in South Carolina, and is designed to reduce erosion, con-trol floods, and provide recreation facilities. The conservation land treatment will improve agriculture and wildlife habitats. The project will also decrease downstream sediments. The only adverse environmental effects will be the permanent loss of land used for agriculture and wildlife habitats and the periodic loss of land which will be inundated by the detention pools. Channel improve-ment will reduce stream fishing. Alternatives con-sidered were no project or elimination of some facets of the proposed project. Irreversible com-mitments of resources would include 2.4 miles of stream channel and land which will be flooded or used in the construction. (Brackins-Florida) W72-10189

NEW BEDFORD AND FAIRHAVEN HARBOR, MASSACHUSETTS--SMALL NAVIGATION PROJECT (DRAFT ENVIRONMENTAL IMPACT STATEMENT).

Corps of Engineers, Waltham, Mass. New England Div

For primary bibliographic entry see Field 06E.

W72-10191

CACHE RIVER BASIN PROJECT, ARKANSAS (DRAFT ENVIRONMENTAL IMPACT STATE-MENT).

Army Engineer District, Memphis, Tenn For primary bibliographic entry see Field 06E. W72-10192

EARTHLOAD ON FLEXIBLE PIPES, (IN NOR-

WEGIAN), Norges Landbrukshoegskole, Vollebekk.

Med Norg Landbrukshogsk. Vol 49, No 22, p 1-10, 1970 Illus. English summary, Illus.
Identifiers: \*Pipe deformation, De \*Earthload, \*Pipes, Shear, Soils, Strength.

For sandy soil, deformations mainly depend on the ror sandy soil, detormations mainly depend on the void ratio or compaction; the pipe strength plays a role only when the soil has loose layering only. In general, the increment of deformation caused by load increase decreases as load increases. For pipes embedded in clay soil a sudden collapse appears with deformation was deformed to the soil as sudden collapse appears. papers when deformation exceeds approximately 20% of the inner diameter, especially in undisturbed quick clay. The critical load (P) may be expressed by P=C1EI/r3+C2s, where C1 and C2 are constants, E is Youngs modulus for the pipe material, I is moment of inertia for the pipe waterial, the wateriad shear estameth of the soil wall, s is the undrained shear strength of the soil and r is the pipe radius. In saturated soils, deformation depends on the drainage conditions of the surrounding soil.--Copyright 1972, Biological Abstracts, Inc. W72-10225

SENSITIVITY OF RESERVOIR DESIGN TO THE GENERATING MECHANISM OF IN-

Thomas J. Watson Research Center, Yorktown Heights, N.Y.

For primary bibliographic entry see Field 06A. W72-10279

LOSS IN CAPACITY OF WATER MAINS, Los Angeles Dept. of Water and Power, Calif. For primary bibliographic entry see Field 05F. W72-10362

OPERATING EXPERIENCE WITH STEEL TANKS.

Marin Municipal Water District, Corte Madera, Calif. For primary bibliographic entry see Field 05F. W72-10365

PERIODIC INSPECTIONS OF TANKS AND

RESERVOIRS,
Montgomery (James M) Consulting Engineers,
Inc., Pasadena, Calif. For primary bibliographic entry see Field 05F. W72-10383

POTABLE-WATER STORAGE RESERVOIRS, Philadelphia Water Dept. Pa. For primary bibliographic entry see Field 05F. W72-10384

#### 8B. Hydraulics

THE HOLEY GATES. Corps of Engineers, Portland, Oreg. North Pacific For primary bibliographic entry see Field 081. W72-10114

WEST VIRGINIA'S BUFFALO CREEK FLOOD: A STUDY OF THE HYDROLOGY AND EN-GINEERING GEOLOGY, Geological Survey, Washington, D.C. W. E. Davies, J. F. Bailey, and D. B. Kelly. Available free on application to USGS, Washing-ton, D.C. 20242. Geological Survey Circular 667, 1972. 32 p, 31 fig, 3 tab, 6 ref.

Descriptors: \*Floods, \*West Virginia, \*Dam failure, \*Dam foundations, Disasters, Dam design, Mudflows, Coal mines, Coal mine wastes, Water ollution control pollution courtor. Identifiers: \*Buffalo Creek (W Va).

ci witi ai hi ci ti ci di si ci ci ai ai ti n

On February 26, 1972, the most destructive flood in West Virginia's history swept through the Buf-falo Creek valley in the southwestern corner of the State, 40 miles south of Charleston. Shortly before 8:00 a.m., a coal-waste dam collapsed on Buffalo Creek, releasing about 17.6 million cubic feet of water. In its 1/2-mile run from the top of the coal-waste dam to the floor of Buffalo Creek, the water dropped about 250 feet. The 10- to 20-foot flood wave traveled through the valley at about 7 feet per second. Between February 24 and 26, the Naper second. Between February 24 and 26, the National Weather Service measured precipitation of 3.7 inches in the general area of Logan County and Buffalo Creek. West Virginia can expect precipitation to equal or exceed 3.7 inches in a 3-day period on the average of once every 2 years. Failure of the coal-waste dam probably occurred through foundation deficiencies, causing sliding and slumping of the front face of the dam. The failure was accelerated by the waterlogged condition of the dam. Three major coal-waste banks were built by dumping waste rock and coal in the narrow yalby dumping waste rock and coal in the narrow val-ley of Middle Fork. Part of the purpose of the dams was to reduce stream pollution by impound-ing the waste-water from the coal washing plant, thus allowing most of the sediment to settle. The porous dams allowed most of the water to filter through, and this clear water was recycled. (K-napp-USGS)
W72-10353

#### 8C. Hydraulic Machinery

MEASURING METHOD FOR EVALUATING THE ABILITY TO PUMP SEMI-LIQUID AND MANURE, Bayerische Landesanstalt ue Landtechnik,

Weihenstephan (West Germany). For primary bibliographic entry see Field 05G. W72-09978

PUMPING CHARACTERISTICS, BIOLOGICAL CHEMICAL PROPERTIES OF DAIRY MANURE SLURRIES, British Columbia Univ., Vancouver. Dept. of

Agricultural Engineering. For primary bibliographic entry see Field 05G.

IMPROVING WATER UTILIZATION EFFI-CIENCY IN AUTOMATIC HYDRAULIC WASTE

REMOVAL,
Agricultural Research Service, Beltsville, Md.
Agricultural Engineering Research Div.
For primary bibliographic entry see Field 05G.

THE 'EFFICIENCY TRANSIENT CONTROL' CONCEPT FOR OPTIMAL LOAD CONTROL IN KAPLAN TURBINE HYDROELECTRIC INSTALLATIONS,

Illinois Univ., Urbana. L. Wozniak.

Paper No 71-WA/FE-23, Transactions American Society of Mechanical Engineers, Ser D--J Basic Engineering, 1971. 6 p, 6 fig, 9 ref, 2 append.

Descriptors: \*Turbine efficiency, \*Mathematical models, \*Simulation, Control, Hydraulic turbines, Performance, Hydraulic machinery, Efficiencies,

Optimization.
Identifiers: \*Load control, \*Kaplan turbines, \*Transients, \*Stability analysis, Load rejection, System stability, Dynamic response, Load

The Kaplan turbine as a reasonable constant effi-ciency generator is becoming more important, with the increasing concern for energy conserva-tion and the need for developing low head installa-tions. Studies were made of modeling, simulation, analysis, and control synthesis for optimizing hydroelectric system performance and of general control applications to Kaplan turbine installations. Basically, the efficiency transient control concept optimizes control of transient behavior to decrease efficiency during the early transient stages of load rejection, while maximizing efficiency during load acceptance. Effects of efficien cy transient control on system stability are analyzed and recommendations for deployment are given. Applications to nonlinear system opera-tions are discussed. To assess the effectiveness of tions are discussed. To assess the effectiveness of the efficiency transient control, a comparison is made with present control schemes. Delay action upon the turbine blades during load increase results in suboptimal performance. To achieve optimum performance, the turbine blade position must be controlled simultaneously with the gate position during load increase. (USBR)

WELDING DEFECTS FROM STEREORADIO-GRAPHS.

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GRAPHS, Illinois Univ., Urbana. R. S. Singh. Photogrammetric Engineering, Vol 37, No 12, p 1249-1254, Dec 1971. 11 fig, 3 tab, 5 ref.

Descriptors: "Nondestructive tests, "Welded joints, "X-ray analysis, Welds, Testing, Photogrammetry, Test procedures, Stereoscopic photography, Measurement, Detection. Identifiers: "Radiography, Ultrasonic tests, Stereoscopic photography, Test results, Parallax.

Results of a study to improve nondestructive testing techniques for detecting and characterizing flaws and for determining the size and depth of the flaws in high-strength welded steel joints are presented. Three techniques were considered radiography, strerooradiography, and ultrasonics. Of these, stereoradiographic measurements by photogrammetric methods offered the best solution. Sterooradiography were taken of a welded tion. Stereoradiographs were taken of a welded joint at different focus-film distances, applying different tube shifts to ascertain the best focus-film to tube-shift ratio. Using parallax measure-ments, depths of the defects and the accuracy of the measurements were determined. (USBR) W72-10116

DRAFT TUBE SURGES--A REVIEW OF PRESENT KNOWLEDGE AND AN ANNOTATED BIBLIOGRAPHY,

Bureau of Reclamation, Denver, Colo.

H. T. Falvey.
Bureau of Reclamation Report REC-ERC-71-42, Dec 1971. 25 p. 7 fig. 68 ref.

Descriptors: \*Draft tubes, \*Surges, \*Turbines, \*Hydraulic machinery, Velocity, Flow characteristics, Frequency, Rotational flow, Hydraulic models, On-site investigations, Turbine efficiency, Francis turbines, Turbine runners, Nonuniform flow, Bibliographies. Identifiers: Splitters, Hydrodynamic stability, Literature surveys, Flow patterns, Air admission, Fins, Guide vanes.

A literature survey and a review of material re-lated to draft tube surges are presented. The litera-ture survey consists of an annotated bibliography of 68 articles published between 1910 and 1970. The review is restricted to 3 major areas: experiments with elementary models, experiments with model and prototype turbines, and field expedients to reduce surging. Velocity distributions and surge frequencies are given special attention in the first 2 areas. Present knowledge is sufficient for prediction the order of magnitude of draft tube for predicting the order of magnitude of draft tube surge frequencies and relative surge amplitudes. Additional studies are needed to refine and extend the scope of prediction methods to include pumps

and pump-turbines. Model testing at full prototype heads is not required to investigate draft tube surg-ing. (USBR) W72-10118

CENTRAL ARIZONA PROJECT, ARIZONA-NEW MEXICO (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Bureau of Reclamation, Washington, D.C. For primary bibliographic entry see Field 06E. W72-10180

PRESSURE SEWER DEMONSTRATION PRO-

JECT, New York State Dept. of Environmental Conser-

vation, Albany.
I. G. Carcich, R. P. Farrell, and L. J. Hetting.
Journal Water Pollution Control Federation, Vol
44, No 2, February 1972, p 165-175. 12 fig, 2 tab,

Descriptors: \*Sewage systems, \*Pressure conduits, \*Research and development, Prototype testing, On-site investigations, Domestic wastes, Pumping plants, Pipes, Operation and maintenance, Economic feasibility, Technical feasibility, Automatic control, Sampling, Monitoring. Identifiers: \*Grinders.

A modular storage grinder pump unit has been designed and constructed for testing of its capa-bility to provide maintenance free pressure sewer on at locations were gravity flow is either impossible or economically unfeasible. 12 units were installed in individual townhouses and their operating characteristics were carefully documented. The pressure main sizes used varied from 1.25 in. near the first unit to 3 in. at the discharge end. Maximum pressure, minimum pressure, water flow, operating time, overflow time, and number of operations are continuously recorded automatically. Total unit cost per household was estimated at \$1000 for construction including piping and wiring. Operational costs for a 300 gpd flow at 25 psi with an incremental power cost of \$0.015/Kwh were estimated at \$0.18/month. (Lowry-Texas) W72-10235

### 8D. Soil Mechanics

TALLAHALA CREEK LAKE, PASCAGOULA RIVER BASIN MISSISSIPPI (DRAFT ENVIRON-MENTAL IMPACT STATEMENT). Army Engineer District, Mobile, Ala

Available from the National Technical Information Service as PB-204 664D, \$3.00 in paper copy, \$0.95 in microfiche. November 1971. 25 p, 1 map.

Descriptors: \*Mississippi, \*Environmental effects, \*Multiple purpose projects, \*Earthdams, Reservoir construction, Impoundments, Water quality control, Water storage, Water supply development, Dam construction, Recreation, Flood protection, Flood control, Watershed management, River basin development, Turbidity, Wildlife habitats, Aquatic habitats, Aquifer systems, Groundwater, Swamps.

Identifiers: \*Environmental impact statements, \*Pascagoula River (Miss).

The project involves construction of a compacted earth fill-dam on Tallahala Creek in Jasper Coun-ty, Mississippi. The multiple-purpose project reservoir will contain 65,500 acre-feet of storage for flood control. The conservation pool will create a 4,435 acre lake with a 39-mile shoreline. Total project land of 15,525 acres is required. Th project area is gentle rolling countryside. The flood plain at the damsite is heavily wooded and swampy. The project will have the following impact on the environment: inundation of agricul-tural and forest lands, improved water recreational opportunities, loss of free flowing stream fishery, loss of wildlife habitat and timber, improved flood protection and water quality, improved water supply source for the surrounding area, temporary supply source for the surrounding area, temporary turbidity, and increased storage of water in the aquifers. Adverse impacts include the loss of wil-dlife habitat, loss of hunting opportunities, and restrictions on oilfield expansion. Alternative means of providing for flood control, water quality control, water supply, recreation, and fish and wil-dlife protection are assessed. (Grant-Florida) W72-09897

FROST BEHAVIOR OF COMPACTED SOILS, Rhode Island Univ., Kingston; and Wisconsin

Univ., Madison.
M. C. Wang, and G. L. Roderick.
Highway Research Record, No 306, p 9-25, 1971. 18 fig, 1 tab, 17 ref, append.

Descriptors: "Soil mechanics, "Frost heaving, "Frozen soils, "Frost action, Compacted soils, Freezing, Ice, Soil texture, Silts, Frost, Ice formation, Soils, X-ray analysis, Soil temperature, Bibliographies, Cold weather construction. Identifiers: Soil freezing cabinets, Water content, Test results. Ice leases.

Soil samples 6 in. high and 3 in. in dia were subjected to temperatures of 25 deg F on top while maintaining the initial uniform temperature of 45 deg F on the base. Results indicated that rate and maximum depth of freezing temperature penetra-tion, water content increase, frost heave, and development of ice segregation depended largely on soil texture compositions and compaction con-ditions. These factors include the initial degree of saturation, molding moisture content, and dry den-sity. Although sand size content was constant, by increasing the clay size content (smaller than 0.002 mm), the frost heave, average water content in-crease, size of ice lenses, and depth of ice frost were decreased. Generally, decreasing the dry density decreased only the rate of frost penetration and increased the amount of water content in-crease and the total heave. However, Providence silt compacted by using standard AASHO com-paction increased frost heave with the increase of molding moisture content regardless of changes in dry density. Frost heave increased linearly with average water content increase. The rate of increase, for a constant degree of saturation, increased as percentage of fines decreased. (USBR) W72-10119

ANALYTICAL MODEL FOR EVALUATING STRESS-STRAIN RESPONSE OF SOILS,

Auburn Univ., Ala. L. M. Kraft, Jr., and N. Krishnamurthy. Journal of Materials, Vol 6, No 4, p 800-817, Dec 1971. 11 fig, 1 tab, 16 ref.

Descriptors: \*Finite element analysis, \*Modulus of elasticity, \*Soil mechanics, Soils, Cohesive soils, Soil properties, Laboratory tests, Schear soils, Soil properties, Laboratory tests, Shear stress, Deformation, Bibliographies, Simulation, Shear tests, Soil analysis, Soil strength. Identifiers: \*Compression tests, \*Triaxial tests, Hyperbolic functions, Analytical method, Stress-

strain curves, Unconfined compression, Direct shear, Stress distribution.

The strength and stress-strain properties of cohesive soils are generally determined from unconfined or triaxial or direct shear tests. Because of the nonuniformity of stress-strain distributions in the test specimens, erroneous conclusions about the stress-strain properties of the soil may result. The finite element method, using nonlinear hyperbolic stress-strain relations, was used to better determine the complex stress-strain action in compression test specimens. A comparison of average compression test results with finite element methods shows the average response predicted compressive strength accurately, but overestimated stiffness by an amount dependent on the specimen length divided by the diameter ratio. Results of the direct shear test comparisons can-

# Field 08-ENGINEERING WORKS

# Group 8D-Soil Mechanics

not be generalized because of uncertain boundary conditions used in the analysis. (USBR) W72-10126

STRESS-STRAIN BEHAVIOR OF FROZEN

FINE-GRAINED SOILS, University of Petroleum and Minerals, Dhahran (Saudi Arabia). W. Akili.

Highway Research Record, No 360, p 1-8 1971. 12

Descriptors: \*Frozen soils, \*Soil mechanics, Silts, Prost action, Freezing, Ice, Soil temperature, Supercooling, Test procedures, Plasticity, Plastic deformation, Cold weather construction, Clays. Identifiers: \*Stress-strain curves, Ultimate strength, Ice formation, Brittleness, Finegrained soils, Test results, Triazial tests, Strain rate.

Constant axial deformation rate tests were performed on frozen cylindrical soil samples to gain information on the effects of soil type, subzero temperature, and axial deformation rates on the stress-strain behavior of frozen fine-grained soils. Conclusions resulting from the tests are: (1) Two types of stress-strain failure behavior have emerged--a brittle type associated with low plasticity soils (clayey silt) and a plastic type as-sociated with high plasticity soils (clay). (2) Low plasticity soils exhibit plastic behavior when tem-perature is relatively high (-1 C), and high plastici-ty soils exhibit brittle behavior when ty soils exhibit brittle behavior when temperature is relatively low (-22 C), or when axial deformation rates are rather fast (0.21 in./min). (3) Ultimate strength depends strongly on temperature, and based on molding conditions and soils used, increases about 3-1/2 times as the temperature decreases from -5 C to -22 C. (4) Ultimate strength depends moderately on deformation rate and increases by 30% when the deformation rate increases from about 0.002 to 0.063 in./min. (5) Data in this investigation suggest that the amount of liquid water and the ratio of liquid water to ice present in a frozen soil matrix control the stress-strain behavior. (USBR) W72-10130

MODEL TESTS OF ENLARGED NAVIGATION CHANNEL AT MILLER SANDS BAR, COLUM-BIA RIVER ESTUARY,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 08A. W72-10144

#### 8F. Concrete

THE EFFECT OF POROSITY ON THE COM-PRESSIVE STRENGTH AND ELASTIC MODU-POLYMER IMPREGNATED OF CONCRETE

Queen's Univ., Kingston (Ontario). O. G. Manning, and B. B. Hope.
Cement and Concrete Research, Vol 1, No 6, p 631-644, Nov 1971. 7 fig, 2 tab, 27 ref.

Descriptors: \*Polymers, \*Porosity, \*Compressive strength, \*Concrete testing, \*Concrete technology, Concrete properties, Bibliographies, Test

procedures. Identifiers: \*Polymer concretes, Modulus of elasticity, Porous concrete, Methyl methacrylate, Mix ratios, Cement paste, Canada, Impregnation, Stress-strain curves, Monomers, Water-cement ratio. Test results.

Three concretes of widely differing water-cement ratios were impregnated with different amounts of methyl methacrylate monomer. The monomer was polymerized thermally, using a free radical initia-tor. The compressive strength and elastic modulus of the polymer-impregnated concrete are shown to be functions of the total porosity of the concrete after polymer impregnation. The elastic modulus of the composite system can be explained on the basis of an aggregate phase and a polymer-im-pregnated cement paste phase. The properties of concrete-polymer materials are controlled by the polymer used. A number of possible mechanisms may explain the role of the polymer in changing the properties of the concrete. The extent of the changes may be determined by the ability of the polymer to: (1) act as a continuous, randomly oriented, reinforcing network; (2) increase the bond between the aggregate and the cement paste; (3) repair microcracking in the cement paste; (4) absorb energy during deformation of the composite system; (5) penetrate and reinforce the micropores of the cement paste; and (6) bond with the hydrated or unhydrated cement. (USBR) W72-10129

#### 8G. Materials

OPERATING EXPERIENCE WITH STEEL TANKS, Marin Municipal Water District, Corte Madera,

For primary bibliographic entry see Field 05F. W72-10365

#### 8H. Rapid Excavation

A US MOLE CONTRACTOR'S VIEWS ON RAPID EXCAVATION, PLANNING AND CON-STRUCTION PROBLEMS, M Constructors, Inc., Solon, Ohio. N. E. Norman Tunnels and Tunnelling, Vol 4, No 1, p 34-35, Jan-

\*Rapid excavation, Descriptors: 'Aspid excavation, 'Tunneling machines, 'Tunnel design, Tunnel construction, Contracting, Specifications, Tunnel supports, Tunnel linings, Bids, Geologic investigations, Groundwater, Excavators, Rock excavation, Rock mechanics, Tunneling, Tunnels, Drilling, Plactice, Placetics, Placetics

Blasting, Planning Identifiers: \*Boring machines, \*Rapid excavation, Diameters, Drillability index, San Francisco Bart

In the past, major rock tunnels were excavated by cyclic mining. With the advent of tunnel boring by mechanical machines (moles), the owner, en-gineer, and contractor must consider both methods. Factors affecting the feasibility of using a mole include: (1) the tunnel shape--circular for moles; (2) the tunnel diameter--normally from 8 to 32 ft dia for moles; (3) the tunnel length-not too short; (4) the tunnel turning radius--not less than 300 ft for most moles; (5) the tunnel incline or decline--not over 45 deg or over 27 deg, respec-tively; (6) the specifications for the temporary supports and permanent linings; (7) the time schedule of the specifications; and (8) the geological conditions. Past experiences have shown that machine bored tunnels have less effect on rock formation stresses than conventionally mined tunnels; there fore, mole excavated tunnels require less support. Because moles are not suitable for all tunnel excavations, adequate geological data are important in evaluating contractor bids. (USBR) W72-10125

#### 81. Fisheries Engineering

THE CAGED CULTURE OF CHANNEL CAT-FISH. Texas A and M Univ., College Station. Agricul-

tural Extension Service For primary bibliographic entry see Field 06B.

THE HOLEY GATES, Corps of Engineers, Portland, Oreg. North Pacific Military Engineers, Vol 64, No 417, p 5-7, Jan-Feb 1972. 3 illus, 2 photo, 1 ref.

Descriptors: \*Water quality, \*Nitrogen, \*Salmon, \*Fishkill, \*Spillways, \*Supersaturation, \*Bulkhead gates, Fish migration, Fish, Gates, Discharge (Water), Fish diseases, Plunge basins, Waterfalls, Fish conservation, Orifices, Fry, Bypasses. Identifiers: "Slotted bulkhead gates, Columbia River, Snake River, Spillway profiles, Slots.

Nitrogen supersaturation is caused by water plunging into a deep pool. The air entrained as the water passes over the crest of a spillway or a waterfall increases the nitrogen saturation to as high as 140% in water downstream from the plunge pools. Such nitrogen supersaturation causes gas bubble disease in stream fish. Because of the proxmity of dams along the Columbia and Snake Rivers, the nitrogen level of the water has risen and is endangering river salmon. Water passing through turbines at powerplants does not contain this high percentage of nitrogen. Holey gates, bulkhead gates with orifices 6 in. high by 5 ft wide, have been installed in skeleton bay areas of powerplants on the Snake River to discharge water through the bays instead of over the spillway dur-ing high spill seasons. This type of discharge was tested and proved very beneficial in reducing the nitrogen content of downstream water. Other methods of fish protection from nitrogen super-saturation in the Columbia and Snake Rivers are discussed. (USBR) W72-10114

FORECAST OF KODIAK ISLAND PINK SAL-MON RUNS FROM ABUNDANCE OF JU-VENILES IN ESTUARIES, Washington Univ., Seattle. Fisheries Research

R. W. Tyler. Available from the National Technical Information Service as COM-71-01133, \$3.00 in paper copy, \$0.95 in microfiche. Final Report from July 1, 1967 to June 30, 1968, October 1, 1971. 37 p, 8 fig, 4 tab, 1 append. NOAA 14-17-0007-741.

Descriptors: \*Pink salmon, \*Sampling, \*Marking techniques, \*Forecasting, \*Ecology, \*Estuaries, \*Migration, Trawling, Nets, Fish populations, Density, Surveys, Alaska, Juvenile fishes. Identifiers: \*Kodiak Island.

Sampling fingerling pink salmon abundance with a Kodiak trawl net was conducted in Alitak, Uganik, Uyak, Ugak and Kaiugnak Bays at Kodiak Island, Alaska, in 1967. Objectives were the development of a prediction method for the return of pink sal-mon from the juveniles migrating seaward, to study the ecology of pink salmon in estuaries and to estimate annual escapement to streams in the Kodiak area. Sampling and marking methods were also tested. Results of the escapement studies showed potential for a good run in 1969. (Ensign-W72-10154

STUDIES OF THE USE OF VERTICAL SUB-STRATES FOR IMPROVING PRODUCTION OF PINK SHRIMP, PENAEUS DUORARUM BUR-

Miami Univ., Fla.

W. L. RICKARUS.

Available from the National Technical Informa-tion Service as COM-71-01064, \$3.00 in paper copy, \$0.95 in microfiche. Sea Grant Technical Bulletin No 10, January 1971. 163 p, 24 fig, 27 tab,

\*Pink shrimp, \*Productions, Descriptors: \*Growth rates, \*Mortality, \*Yield equations, \*Fouling, \*Algae, \*Chlorophyta, Cyanophyta, \*Vertical substrates. Identifiers: Molting.

Three experiments were conducted to determine the effects of vertical substrates upon pink shrimp growth, mortality and total yield. Molting, behavior, and utilization of the substrates by the shrimp and the fouling organisms growing on them were also investigated. Significantly greater yields were realized from shrimp grown in tanks where fouling organisms were available as food than from shrimp with no fouling food source. Filamentous green algae, Chladophora and Enteromorpha, were readily consumed by pink shrimp and have more nutritional value than the blue-green algae. If conditions in the culture enclosures are controlled such as good light penetration, good water circulation, a shallow culture and the absence of uneaten food, the green algae would be encouraged and a greater percentage of the fouling community biomass will be composed of acceptable foods. [Ensign-PAI] (Ensign-PAI) W72-10157

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A STUDY OF THE FOOD OF JUVENILE MIGRATING PINK SHRIMP, PENAEUS DUORARUM BURKENROAD,

Miami Univ., Fla.
For primary bibliographic entry see Field 02L.
W72-10159

FISHERY RESOURCES ATLAS I - NEW YORK TO FLORIDA, Miami Univ., Fla. For primary bibliographic entry see Field 02L. W72-10164

PHOTOPERIODIC ACTIVITY CHANGES IN JUVENILE SOCKEYE SALMON (ONCO-RYHYNCHUS NERKA), California Univ., San Diego, La Jolla. School of

For primary bibliographic entry see Field 02I. W72-10207

FISHCULTURE SURVEY REPORT FOR WEST CENTRAL AFRICA. INCREASING FISH PRODUCTION BY IMPROVED FISHCUL-

TURES,
Auburn Univ., Ala.
D.D. Moss, G. B. Pardue, and M. J. Danner.
Available from the National Technical Information Service as PB-206 977, \$3.00 in paper copy, \$0.95 in microfiche. June 30, 1969. 125 p, 7 fig, 10 maps and illus. Project No. AID/csd-1581.

Descriptors: "Aquiculture, Surveys, Economics, \*Africa, Fisheries, Marketing, Drying, Shrimp, Shellfish, Freshwater fish, Marine fish. Identifiers: Cameroon (Africa), Central African Republic, Ghana (Africa), Ivory Coast (Africa), Nigeria (Africa), Senegal (Africa), Togo (Africa).

Intensive fishculture is an effective means of producing protein of high quality. In view of this, a survey was made of the status and needs of fish-culture activities in the following West Central African nations: Cameroon, Central African Republic, Ghana, Ivory Coast, Nigeria, Senegal, and Togo. Attention was given to existing programs being carried out in inland fisheries, with emphasis on fishculture projects, and to the marketing and economics of the fisheries in each country. country. W72-10436

THE SHAD FISHERY OF THE ALTAMAHA RIVER, GEORGIA, Georgis Game and Fish Commission, Brunswick. Marine Fisheries Div.

For primary bibliographic entry see Field 05C. W72-10437

THE DISTRIBUTION AND DENSITY OF THE BRACKISH WATER CLAM, RANGIA CUNEATA IN THE ALTAMAHA RIVER, GEOR-

Georgia Game and Fish Commission, Brunswick. Marine Fisheries Div.

For primary bibliographic entry see Field 05C. W72-10438

#### 09. MANPOWER, GRANTS AND FACILITIES

#### 9A. Education (Extramural)

SEVENTH ANNUAL REPORT OF THE WATER RESOURCES RESEARCH INSTITUTE OF THE UNIVERSITY OF WYOMING, AUGUST 1, 1970 (ACTIVITIES DURING FY 1971).

Wyoming Univ., Laramie. Water Resources Research Inst. For primary bibliographic entry see Field 09D. W72-10318

ANNUAL REPORT 1970-1971.
Hawaii Univ., Honolulu. Water Resources
Research Center.
For primary bibliographic entry see Field 09D.
W72-10319

#### 9C. Research Facilities

SHRIMP MARICULTURE AT THE BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY, Bureau of Commercial Fisheries, Galveston, Tex. Biological Lab.

For primary bibliographic entry see Field 06B. W72-10043

#### 9D. Grants, Contracts, and Research Act Allotments

THE SEA GRANT PROGRAM AND COASTAL DEVELOPMENT,
Texas A and M Univ., College Station.
J. C. Calhoun, Jr.

In: Proceedings of the Coastal Land Resources Conference, June 16-17, 1970, Galveston, Texas Agricultural Ext. Serv. and Texas A and M Univ. Sea Grant Program, September, 1970, p 1-5.

Descriptors: \*Coasts, \*Marine biology, Oceanography, Economics, Pollution abatement, Grants, Projects. Identifiers: Coastal regions.

The implications of the Sea Grant College and Program Act of 1965 are discussed, and the Sea Grant Program is briefly described. The purpose of the Act was to create a program that would focus the talents of the universities toward accelerating the development of marine resources. Administrative responsibility for the program was assigned to the National Science Foundation. While no Sea Grant National Science Foundation. While no Sea Grant Colleges have yet been designated, NSF has established eight institutional awards which have been granted to the Universities of Rhode Island, Miami (Florida), Wisconsin, Michigan, Washington, and Hawaii and to Texas A and M and Oregon State Universities. The individual activities of the program may include the development of new courses and curricula, extension activities, advisory services, dissemination of information to the public, and research. Research projects undertaken at Texas A and M in response to the program include (1) projects related to fish diseases and handling of marine animals; (2) research in economics; (3) projects in pollution and environeconomics; (3) projects in pollution and environ-mental engineering; and (4) studies on the pond culture of shrimp. Also, Texas A and M has developed several graduate courses under this program, including courses in coastal engineering, ocean engineering, sea-food technology, underwater acoustics, and special areas of marine biology. (See also W72-10040) (Settle-Wisconsin) W72-10041

SEVENTH ANNUAL REPORT OF THE WATER RESOURCES RESEARCH INSTITUTE OF THE UNIVERSITY OF WYOMING, AUGUST 1, 1970 (ACTIVITIES DURING FY 1971).

Wyoming Univ., Laramie. Water Resources Research Inst.

August 1, 1970. 72 p, 2 append. OWRR A-999-WYO (15).

Descriptors: \*Wyoming, Research and develop-ment, \*Projects, Planning, Water quality, Water utilization, Irrigation, Runoff, Precipitation gages, \*Water Resources Institute.

Organization, program and activities of the Wyoming Water Resources Research Institute are described for the period July 1, 1970 through June 30, 1971. The Institute underwent reorganization, and the new organization is described. The Water and the new organization is described. The water Resources Operations Study has been established as a single multidisciplinary University-wide research project; its initial objectives are the determination of criteria for water resource planning, bio-physical relationships in the hydrologic cycle, interrelationships of water qualihydrologic cycle, interrelationships of water quality and water utilization, and principles of analysis of water resource operations. An evaluation is underway of the game and fish resources in relation to the future utilization of the water of the Green River, Wyoming. Other projects include the study of consumptive use by high mountain meadow irrigation, state water planning, meteorological influence on snow runoff forecasts, and the use of snow fences for shielding precipitation gages.

W72-10318

ANNUAL REPORT 1970-1971.

Hawaii Univ., Honolulu. Water Resources Research Center.

(1971), 77 p. OWRR A-999-HI (6).

Descriptors: \*Hawaii, \*Projects, Research and development, Water quality, Waste water (Pollution), Water pollution, Surface runoff, Water reuse, Irrigation, Aquifers, Remote sensing, Planning, Water conservation, Water measurement, Groundwater, Logging, \*Water Resources Institute of the Project of the Pro

Research program activities and accomplishments of the Hawaii Water Resources Research Center Research program activities and accomplishments of the Hawaii Water Resources Research Center for fiscal year 1971-72 are summarized. Projects dealing with water quality problems include studies of quality of coastal waters, Oahu basal water quality, pollution and reuse of wastewater effluents and surface runoff in Hawaiii, and pollution in Hawaiiian watersheds. Related to water quantity problems are projects dealing with the water budget of sprinkler-irrigated sugarcane, evaluation of artificial recharge in Hawaiian ghybenherzberg aquifers, remote sensing of water with electromagnetic radiation, radiation well logging in Hawaii and environmental isotope applications to Hawaiian ghyben-herzberg lens. Water resources planning projects include economic systems simulation of water supply-demand relationships, and preliminary study of water resources institutions in Hawaii. Other projects include rainfall and runoff data nets for Hawaii, analog simulation of tidal effects on ground water aquifers, study of thermal properties of sea water, a hydrologic data network and Taiwan ground water supply.

# 10. SCIENTIFIC AND TECHNICAL INFORMATION

RECYCLING AND ECOSYSTEM RESPONSE, Michigan State Univ., East Lansing. Inst. of Water Research. For primary bibliographic entry see Field 06G. W72-10323

# Field 10-SCIENTIFIC AND TECHNICAL INFORMATION

## Group 10A—Acquisition and Processing

#### 10A. Acquisition AND Processing

A COMPUTER PROGRAM FOR CREATING KEYWORD INDEXES TO TEXTUAL DATA FILES, Geological Survey, Washington, D.C.

D. W. Moody. Geological Survey Open-file Report, June 1972. 27 p, 7 fig, 1 tab, 2 ref.

Descriptors: \*Information retrieval, \*Computer programs, \*Documentation, Publications, Automation, Bibliographies, Abstracts, Technical Writ-Identifiers: \*Keyword indexes, GIPSY data base.

A keyword-in-context (KWIC) or out-of-context (KWOC) index is a convenient means of organiz-ing information. This keyword index program can be used to create either KWIC or KWOC indexes of bibliographic references or other types of information punched on cards, typed on optical scanner sheets, or retrieved from various Department of Interior's data bases using the Generalized Infor-mation Processing System (GIPSY). The index consists of a 'bibliographic' section and a keyword section based on the permutation of document ti-tles, project titles, environmental impact state-ment titles, maps, etc. or lists of descriptors. The program can also create a back-of-the-book index to documents from a list of descriptors. By providing the user with a wide range of input and output options, the program provides the researcher, manager, or librarian with a means of maintaining a list and index to documents in a small library, reprint collection, or office file. (Moody-USGS) W72-10346

#### 10B. Reference and Retrieval

DRAFT TUBE SURGES--A REVIEW OF PRESENT KNOWLEDGE AND AN ANNOTATED BIBLIOGRAPHY, Bureau of Reclamation, Denver, Colo. For primary bibliographic entry see Field 08C. W72-10118

#### 10C. Secondary Publication **AND Distribution**

NITRILOTRIACETIC ACID: A LITERATURE SURVEY, Water Pollution Research Lab., Stevenage (England). For primary bibliographic entry see Field 05B. W72-09926

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on the Water-Absorbing Capacity and Frac-	Process for Sewage Treatment,	W72-10176 6I
tional Composition of the Water of Plant Tis-	W72-09802 5D	m
sues, (In Russian), W72-09936 2I	Combined Steel Mill and Municipal Waste-	The Comprehensive Basin Study on Wabasi River, Illinois, Indiana and Ohio (Draft En
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Acetic Acid and Pulping Chemicals,		vironmental Impact Statement).
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## CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation. Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Public water supply treatment technology at the American Water Works Association.

## Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agenc
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.
- Effect on water quality of irrigation return flows, at the Department of Agricultural Engineering of Colorado State University.

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